Agilent 8453 Dissolution Testing System



Installing and Operating Manual

Agilent Technologies

Notices

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Introduction

This section introduces you to Agilent dissolution testing software and explains how to use this handbook to install the hardware and software.

What is Dissolution Testing?

The dissolution testing software for the Agilent 8453 UV-visible spectrophotometer and Agilent ChemStation automates totally the process of measuring the rates of release of active ingredients from formulations into solutions. Your dissolution testing software is provided on CD-ROM to install and operate in the graphic environment of the supported Microsoft Windows operating system(s). For details see the *Specifications* for your *Agilent ChemStation for UV-visible Spectroscopy Systems*. The software automates the sampling, measuring, data processing, and reporting of the dissolution test. The dissolution testing software requires that you develop your own specific testing method for either single-component or multicomponent analysis. The software provides all the necessary features for developing a test method.

The dissolution testing software samples and measures your samples automatically in the Agilent 8453 UV-visible spectrophotometer. The software compares the absorbance measurements with previously measured known standards. The software calculates the concentration of component in your samples and calculates dissolution results automatically.

You choose in your test method the dissolution results that you want reported. The dissolution testing software calculates the following choices of dissolution results for the ingredient of interest:

- % Dissolved or released
- Weight dissolved or released per tablet
- Weight dissolved or released per weight of tablet

These results are based on label weight or on tablet weight.

What To Do

You use this handbook to set up your dissolution testing system. This is what you do:

- follow the instructions in this handbook,
- refer to other handbooks when necessary, then
- return to the next step in this handbook for completion of setting up.

What You Need

Your dissolution testing system comprises the following components:

Spectrophotometer	Agilent 8453 UV-visible spectrophotometer.
Sample Introduction System	8-port valve and single channel pump, multicell transport with multichannel pump, or multicell transport with eight-port valve and two single-channel pumps.
Personal Computer	PC with Microsoft Windows operating system and printer.
Application Software	Agilent ChemStation general purpose software and dissolution testing software for UV-visible spectroscopy.

See your packing check list for your system options. You use the system with your dissolution vessels and bath.

What You Install

- Agilent 8453 UV-visible spectroscopy system
- Dissolution sampling system

The chapters that follow describe the installation procedures for dissolution sampling systems.

In This Guide...

This handbook provides you with instructions for installing your Agilent dissolution testing system.

1 Site Requirements and Specifications

This chapter describes the site requirements and contains the specifications for all units applied.

2 Setting Up

This chapter describes how to set up your Agilent 8453 UV-visible spectroscopy system and dissolution sampling system.

3 Using the Peristaltic Pumps 1VS and 8VS

This chapter describes how to install, operate, maintain and service the peristaltic pumps.

4 Using the Valve Unit and Valve-pump Controller

This chapter describes how to install, operate, maintain and service the valve unit and valve-pump controller.

5 Parts for Dissolution Testing

This chapter contains lists of parts and their numbers you need for the different configurations of dissolution testing systems.

A Safety Information

This chapter contains relevant safety information.

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1
Site Requirements and Specifications

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Site Requirements

Site Requirements

A suitable environment is important to ensure optimal performance of the entire system for automated dissolution testing. The components are designed for indoor use only in a clean lab environment.

All components required for your system must be available. For the dissolution testing equipment refer to the supplier's documentation.

NOTE Make sure your Agilent spectroscopy system is installed and qualified before you add your dissolution sampling system.

General Considerations

CAUTION Only use the equipment as described and specified in this handbook. If used in a manner not specified by Agilent, protection of the equipment may be impaired.

Power Consideration

The peristaltic pumps 1FS, 1VS and 8VS and the valve-pump controller are available in two versions for line voltages of 100 - 120 V AC or 220 - 240 V AC. Before you connect your device to a power outlet, make sure your device version is in coincidence with your line voltage supply.

Power Cords

Different power cords are offered as options with the sampling system components. The female end of the power cords is identical. It plugs into the power-input socket at the rear of the different peristaltic pumps and the valve-pump controller. The male end of each power cord is different and designed to match the wall socket of a particular country or region.

WARNING

The absence of ground connection and the use of an unspecified power cord can lead to electric shock or short circuit.

Electric Shock

- Never operate your instrumentation from a power outlet that has no ground connection.
- Never use a power cord other than the Agilent Technologies power cord designed for your region.

WARNING

Use of non Agilent cables

The use of cables which haven't been supplied by Agilent Technologies can lead to damage of the electronic components or personal injury.

- Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.

Bench Space

The sampling system is attached to a dissolution tester and the 8453 spectrophotometer. Agilent recommends a linear arrangement on a lab bench of the dissolution tester, the sampling devices, the 8453 spectrophotometer and the PC.

For the optimum arrangement the tubing connecting the vessel probe or valve outlet to the flow cell inlet should be as short as possible. In case of a single bath system, the 8453 should be adjacent to the dissolution tester. In a multibath environment, the 8453 should be in the center of the arrangement.

The sampling devices applied should be visible to facilitate a check for proper operation.

NOTE Make sure the bench is designed to carry the weight of all components of your automated dissolution testing system.

Environment

Your system will work as specified individually for each of the components. The operation limits here are defined by the weakest specification of all applied devices.

Specifications for the Agilent devices are with the respective manuals. For the sampling devices please check the respective specifications later in this chapter.

CAUTION Condensation conditions must be avoided. The electronics of the devices may be damaged if condensation occurs.

Specifications

Peristaltic Pumps 1VS and 8VS

The peristaltic pumps 1VS and 8VS are for one and eight pumping channels. The pumps are designed for liquid samples. Due to the peristaltic pump principle only the tubing is in contact with the liquid.

The pumps can be operated manually and remotely via a digital interface. If used for automated sampling in the dissolution testing application, only the remote operation is applied.

NOTE

Connect the pump 1VS to the valve-pump-controller only by the controller-to-pump cable (PN G1103-61612) provided by Agilent.

Connect the pump 8VS to the 8453 spectrophotometer only by the GPIO-to-pump cable (PN G1103-61607) provided by Agilent

Table 1 Physical Specifications Peristaltic Pumps 1VS and 8VS

Type	Specification	Comments
Dimensions	15.9 cm (6.2 inches) wide 19.3 cm (7.6 inches) deep 11.2 cm (4.4 inches) high 15.9 cm (6.2 inches) wide 26.5 cm (10.5 inches) deep 11.2 cm (4.4 inches) high	Pump 1VS Pump 8VS
Weight	3.25 kg (7.2 lbs) 3.3 kg (7.3 lbs)	Pump 1VS Pump 8VS
Line voltage	100–120 V AC ± 10% 220–240 V AC ± 10%	Select 115 V AC Select 230 V AC
Line frequency	50–60 Hz	
Power consumption	55 VA	Maximum
Ambient operating temperature	5–40 °C (41–104 °F)	

Table 1 Physical Specifications (continued)Peristaltic Pumps 1VS and 8VS

Type	Specification	Comments
Ambient non-operating temperature	-40–70 °C (-4–158 °F)	
Humidity	<90%, at 25–40 °C (77–104 °F)	Non-condensing
Operating altitude	Up to 2000 m (6,500 ft)	
Non-operating altitude	Up to 4600 m (14,950 ft)	For storing the instrument
Safety standards: IEC, CSA, UL	Installation Category II, Pollution Degree 2	For indoor use only

Table 2 Performance Specifications Peristaltic Pumps 1VS and 8VS

Type	Specification	Comments
Flow rate	2 - 14 ml/min	Pump tubing with 2.06 mm inner diameter
Speed	1 - 67 rpm	clock wise and counter clockwise operation
Pumping pressure	< 2 bar (30 psi)	
Pumping distance	< 7 m	

Valve Pump Controller

The valve pump controller is used with all dissolution sampling systems based on stream selecting valves. The sampling systems are referred as valve sampling systems if a single dissolution tester is combined with the spectrophotometer or a multibath sampling system if more than one dissolution tester is hooked to the instrument.

A maximum of four valve units and four peristaltic pumps 1VS can be controlled by the valve pump controller.

NOTE Connect the valve pump controller to the 8453 spectrophotometer only by the GPIO-to-controller cable (PN G1103-61610) provided by Agilent.

Table 3 Physical Specifications Valve Pump Controller

Type	Specification	Comments
Dimensions	16.0 cm (6.3 inches) wide 18.0 cm (7.1 inches) deep 11.0 cm (4.3 inches) high	without connected cables
Weight	2.4 kg (5.3 lbs)	
Line voltage	100–120 V AC ± 10% 220–240 V AC ± 10%	Select 115 V AC Select 230 V AC
Line frequency	50–60 Hz ± 5%	
Power consumption	55 VA	Maximum
Ambient operating temperature	5–40 °C (41–104 °F)	
Ambient non-operating temperature	-40–70 °C (-4–158 °F)	
Humidity	<90%, at 25–40 °C (77–104 °F)	Non-condensing
Operating altitude	Up to 2000 m (6,500 ft)	
Non-operating altitude	Up to 4600 m (14,950 ft)	For storing the instrument
Safety standards: IEC, CSA, UL	Installation Category II, Pollution Degree 2	For indoor use only

Table 4 Performance Specifications Valve Pump Controller

Type	Specification	Comments
Interface to spectrophotometer	D-sub, 25-pin female connector	8 bit digital input/output TTL level
Interface to pumps (4 connectors)	D-sub, 9-pin female connector	2 bit digital output TTL level
Interface to valve units (4 connectors)	D-sub, 15-pin female connector	8 bit digital input/output TTL level 5 V DC power supply 24 V AC power supply

Valve unit

The valve unit gets its power from the valve-pump controller. Up to four valve units can be connected to a single valve pump controller.

NOTE Connect the valve unit to the valve-pump controller only by the controller-to-valve cable (PN 5062-2407) provided by Agilent.

Table 5 Physical Specifications Valve Unit

Type	Specification	Comments
Dimensions	15.9 cm (6.2 inches) wide 26.5 cm (10.5 inches) deep 11.2 cm (4.4 inches) high	Without tubing connected
Weight	3 kg (6.6 lbs)	
Power Supply	24 V AC ± 10%	provided by Valve-Pump Controller
Line frequency	50 or 60 Hz	Line frequency of Valve-Pump Controller
Ambient operating temperature	5–40 °C (41–104 °F)	
Ambient non-operating temperature	-40–70 °C (-4–158 °F)	
Humidity	<90%, at 25–40 °C (77–104 °F)	Non-condensing
Operating altitude	Up to 2000 m (6,500 ft)	
Non-operating altitude	Up to 4600 m (14,950 ft)	For storing the instrument
Ambient non-operating temperature	-40–70 °C (-4–158 °F)	
Savety considerations	Pollution degree 2	For indoor use only

Table 6 Performance Specifications Valve Unit

Type	Specification	Comments
Switching speed	< 500 ms	from port to adjacent port

Table 6 Performance Specifications Valve Unit

Valve stator	PPS	
Valve rotor	TFE composite	
Temperature range of solvent	5–75 °C (41–167 °F)	
Pressure	Less than or equal to ambient pressure	
Pressure drop across valve	< 0.2 bar (2.9 psi) at 5 ml/min	
Flow rate through valve	Typically 10 ml/min	
Solvents	Compatible with PPS and TFE composite materials, pH 1–14	
Lifetime	Typically 100,000 switching cycles	Pumping water at 20 °C (68 °F) through each port during switching. A switching cycle is a 360° turn of the valve. Depending on your application, you may need to clean the valve at regular intervals.

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Setting Up Your Spectrophotometer

Refer to your *Installing Your UV-visible Spectroscopy System* handbook. Read the information and do the installation step by step.

You will do these things:

- Read about the power and site requirements for your instrument.
- Unpack and set up your Agilent 8453 UV-visible spectroscopy system.

NOTE When you have installed your spectroscopy system, return to this handbook.

Setting Up Your Sampling System

There are different sampling systems which you can use with the dissolution testing software:

- Offline systems
- Multicell-based system (G1127A)
- Valve-based system (G1128A)
- Multibath system (G1129A/G1130A)

Naming Parts

Table 7 shows the naming for the various fittings of the different sampling systems.

Table 7 Descriptions of Fittings

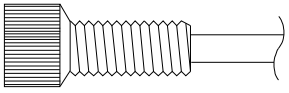
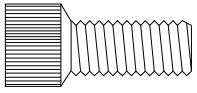
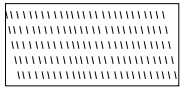
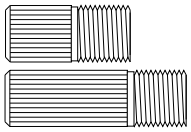
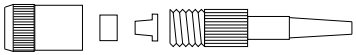
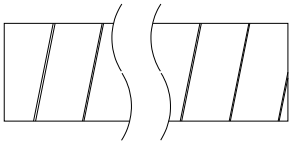
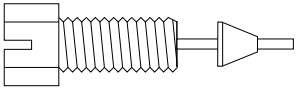
Parts	Description*
	Dissolution probe, including fitting and ferrule
	Fitting, nut
	Ferrule
	Union

Table 7 Descriptions of Fittings (continued)

Parts	Description*
	Cell fittings, short and long
	Cell ferrule
	Conical adapter
	Spiral tubing wrap
	Fitting and ferrule for connection to valve unit

* For more detailed descriptions and part numbers, see UV-visible section of Agilent's *Accessories and Supplies for UV-visible Spectroscopy* Catalog.

There are eight colors for identifying the tubing in the different vessels and flow cells. If you assemble the tubing system according to Table 8 these colors correspond to the colors in the software for the dissolution profiles. However, the dissolution testing software cannot show brown and uses black for these brown fittings.

Table 8 Color Coding

Color	Vessel
Brown	Vessel 1
Red	Vessel 2
Yellow	Vessel 3
Green	Vessel 4

Table 8 Color Coding (continued)

Color	Vessel
Blue	Vessel 5
Violet	Vessel 6
Grey	Blank
Orange	Control
White	Common, e.g. conical adapter
Black + colored band	Special cell fittings

You must adjust the unions to the fittings so that all the connections are leak tight.

Dissolution Bath

A dissolution probe kit and a packet of 40 filter tips are part of the valve and multicell transport sampling systems.

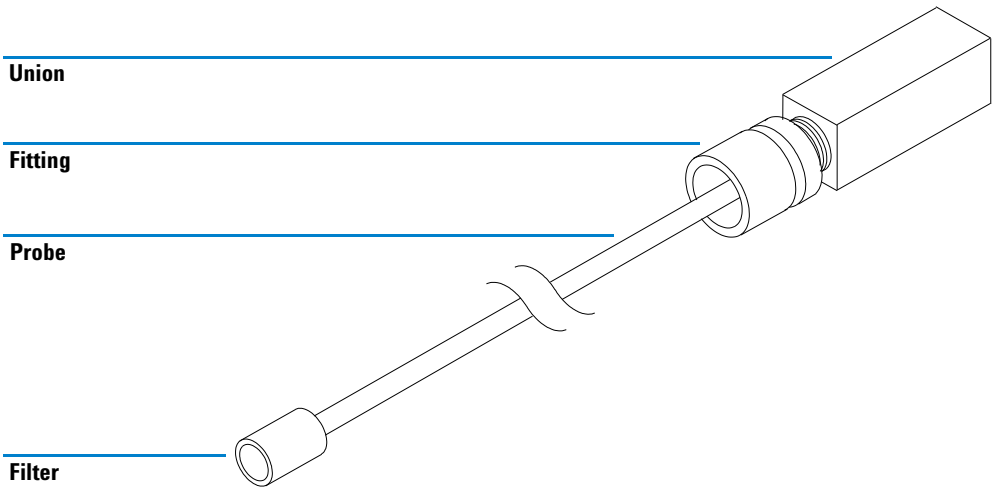


Figure 1 Probe for Dissolution Bath

A dissolution probe kit consists of eight fittings with a probe (25 cm, 1/8-inch od) and union attached.

1 Cut the probes to a suitable length for your dissolution bath, if necessary.

2 Attach a filter to each probe.

NOTE If you are using other filters with smaller pore size than 45 µm they may reduce the flow. Some filters, if not washed before use, release monomers that pollute the flow cell windows and or cause air bubbles to stick in the flow cells.

3 Insert the probes into your dissolution vessels.

Attach the necessary fitting and tubing to the union, see “Connecting Multicell System Tubing” on page 31, and “Connecting Valve System Tubing” on page 49.

Installing a Multicell-transport-based Sampling System

The multicell-transport-based sampling system samples from one bath online. The system uses a multicell transport with eight flow cells—one cell for the blank, up to six cells for the individual vessels and one cell for a control—and a multichannel pump to sample all vessels simultaneously. The dissolution medium is recycled so that there is no change due to the sampling system in medium volume during the test.

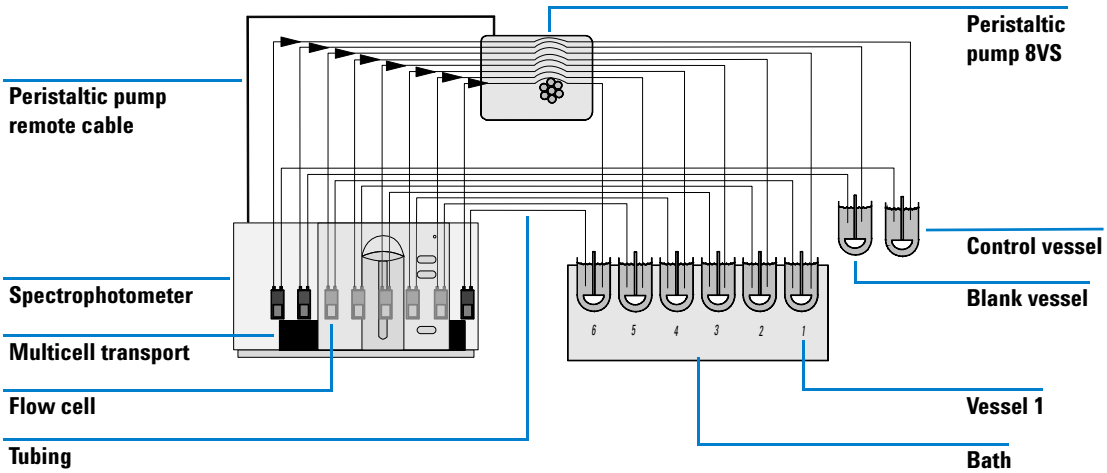


Figure 2 Multicell-transport-based Sampling System (G1127A)

To install the multicell system you will need the following parts:

- 8-Position multicell transport
- Peristaltic pump 8VS
- Multicell tubing kit
- Flow cells, 1 mm path length (8)
- Peristaltic pump–remote cable
- Dissolution probe kit

NOTE

Position 1 is at the left side of the multicell transport.
Position 8 is at the right side of the multicell transport.

Installing Your Eight-position Multicell Transport

To install your eight-position multicell transport in the Agilent 8453 spectrophotometer, refer to your *Multicell Transport for Agilent 8453 UV-visible Spectrophotometer Operator's Manual.*

Installing Your Peristaltic Pump 8VS

Each peristaltic pump 8VS is identified by a serial number on a label at the rear. Write down the serial number of your pump here:

_____

Installing the pump comprises three stages:

- "Stage 1: Installing the Cables" on page 28,
- "Stage 2: Installing the Pump Tubing" on page 29, and
- "Stage 3: Installing the Tubing Cassette" on page 30.

Stage 1: Installing the Cables

The voltage selector and cable connectors are at the rear panel.

WARNING

Make sure line-power cord is disconnected before changing line-voltage setting.

1. Set the correct voltage option (115 V or 230 V) for operation from your line power supply.
2. Check the correct fuse is installed.
3. Push connector of power cord into line-power socket.

4 You connect the multichannel pump to the Agilent 8453 spectrophotometer with the multichannel pump–remote cable (part number G1103-61607).

5 Push connector of the peristaltic pump–remote cable (part number G1103-61607) into the remote control connector on the rear of the pump. When this cable is connected, the control switch on the front panel does not function. This prevents you using the pump manually during automatic operation.

6 Set the flow control to 40 for a flow rate of about 6.5 ml/min.

Stage 2: Installing the Pump Tubing

The pump tubing for the pump is 2.06 mm i.d. The pump includes one pack of pump tubing, 12 pieces per pack (part number 5041-2166). There are three fixing-collars on each piece of pump tubing. This allows you to use the pump tubing in two positions.

1 Put the pump tubing in the tubing-cassette, locating the fixing-collars on each side of the cassette in the locating holes. Make sure that the fixing-collars are pointing upwards and the tubing cannot slide out of the cassette.

2 Repeat for each of the cassettes.

Stage 3: Installing the Tubing Cassette

1 Put the tubing cassette on the pressure-wheel assembly by placing the cassette on the mounting pivot, see Figure 3).

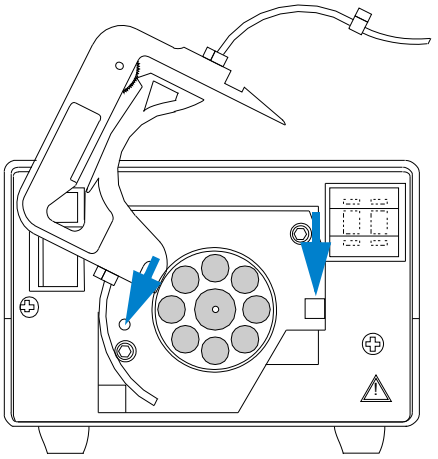


Figure 3 Placing Tubing-Cassette

2 Press the cassette down to lock the right side onto the locking-bar.

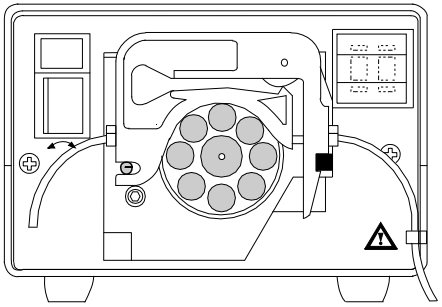


Figure 4 Tubing-Cassette in Position

3 Repeat for each of the cassettes.

More detailed information on using the pump can be found in Chapter 3, “Using the Peristaltic Pumps 1VS and 8VS”.

Connecting Multicell System Tubing

You use the multicell transport in the Agilent 8453 spectrophotometer with the peristaltic pump 8VS. The direction of flow for your samples is from the dissolution vessels via the flow cells in the multicell transport holder through the pump tubing returning to the bath.

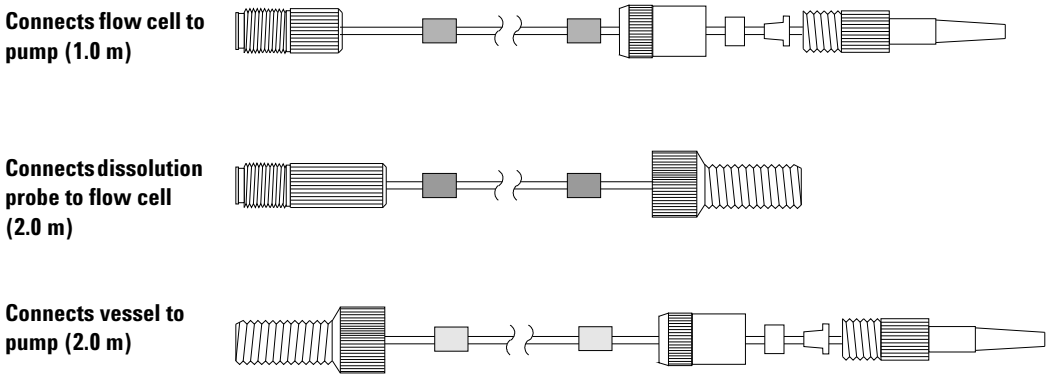


Figure 5 Multicell Tubing Kit

The tubing in the multicell tubing kit have colored heat-shrunk sheaths. You identify the different tubing by the colored heat-shrunk sheaths and the length. There are eight pieces of each different tubing. Match the colors of the fittings so that each tubing line has the same colors on all the fittings, see Table 8 on page 24.

1 Insert the flow cells into the multicell transport in the Agilent 8453 spectrophotometer.

2 Connect the flow cell to the pump, see Figure 6—connect the 1.0 m tubing with the short cell fitting to the outlet of the flow cell, and the colored fitting to a union. Connect the conical adapter to the union. Insert a conical adapter into the pump tubing on the inlet side of the pump.

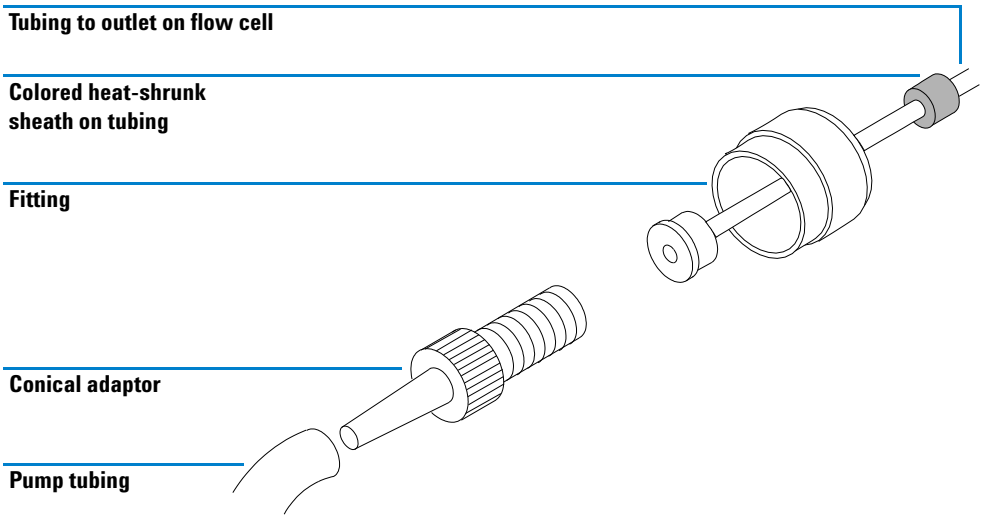


Figure 6 Connecting Flow Cell to Pump

3 Connect the dissolution probes to the flow cells—connect the 2.0 m tubing, see Figure 7, with the long cell fitting to the inlet (marked with ↓) of the flow cell. Then, connect the fitting to the union attached to the dissolution probe.

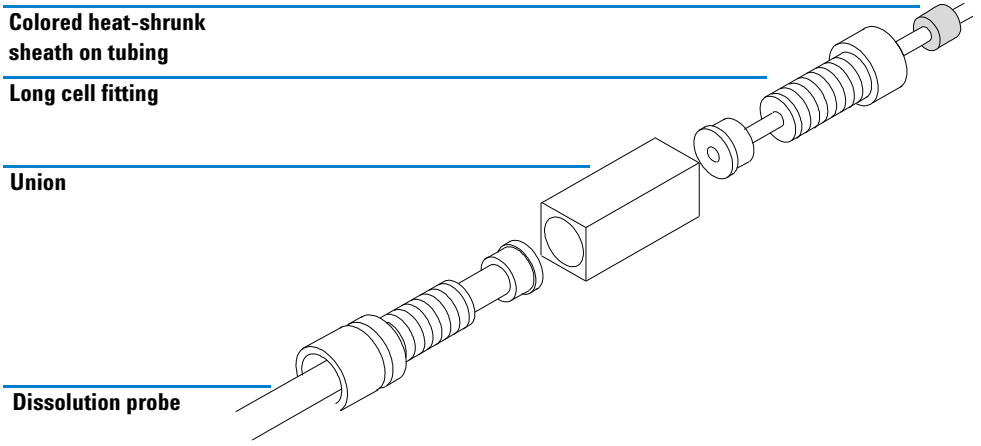


Figure 7 Connecting Dissolution Probes to Fitting

4 Connect the 2.0 m tubing with the colored heat-shrunk sheath at one end to a union.

5 Connect the union to a conical adapter.

6 Insert a conical adapter into the pump tubing on the outlet side of the pump.

7 Insert the open ends of the tubing into the vessels.

8 Bundle your tubing together with the spiral tubing wrap to keep it from kinking.

Troubleshooting

Table 9 Troubleshooting Multicell-based Sampling Systems

Problem	Action
Invalid or unusual spectrum caused by sticky bubbles in flow cell.	Sticky bubbles on the window of the flow cell can be minimized by cleaning the tubing and flow cell with a solution of 2% passivating and cleaning fluid (part number 5062-8529).
Invalid or unusual spectrum caused by bubbles in the flow cell moving up through the light path during measurement.	Increase the wait time before taking the spectrum to allow the bubble to move up outside the light path. Use flow cells with a wide aperture.
Cross contamination.	Check the flow rate of the pump and replace the pump tubing if necessary. Specify a longer pump time in your method. Adjust the speed control of the peristaltic pump to a higher speed. Check tubing for possible flow restrictions.
Extensive bubbles in tubing.	Check tubing for possible air leaks. Check surfaces of the ferrules and exchange ferrules which are scratched. Tighten fittings and unions. Change filter tips and/or use filter tips with a wider pore size, if appropriate.
Different readings on flow cells using the same solution.	Measure zero cells on water to compensate for different absorbancies to the windows. Specify individual path lengths in the Agilent ChemStation software to compensate for different path lengths of the cells.

Part Numbers

Table 10 Ordering Information for Replacement Parts and Tubing Kits*

Description	Part Number
Eight-position multicell transport	G1120A
Peristaltic pump 8VS drive assembly, 115 V	89092-60001
Peristaltic pump 8VS drive assembly, 230 V	89092-60002
Peristaltic pump 8VS pressure-wheel assembly 8 channel	89092-60003
Peristaltic pump–remote cable	G1103-61607
Filter tips (pack of 1000)	5181-1246
Flow cell, 1 mm path length	5063-6570
Multicell tubing kit†	5042-1330
Peristaltic pump tubing, 2.06 mm inner diameter (12)	5041-2166
Dissolution probe kit‡	5042-1332
Teflon tubing kit, 0.8 mm inner diameter, 1.6 mm outer diameter (10 m)	5041-2191

* For part numbers of cell fittings and ferrules, tubing fittings, ferrules, conical adapters and unions, see the UV-visible section of Agilent's *Accessories and Supplies for UV-visible Spectroscopy* Catalog.

† Supplied with pre assembled tubing and fittings.

‡ Supplied pre assembled.

See Table 7 on page 23 for details of fittings.

Installing a Valve-based Sampling System

The valve-based sampling system samples from one bath online. The system uses an eight-port stream-selection valve to sample up to eight vessels sequentially. Each time a sample is taken a certain amount of dissolution medium is lost to waste.

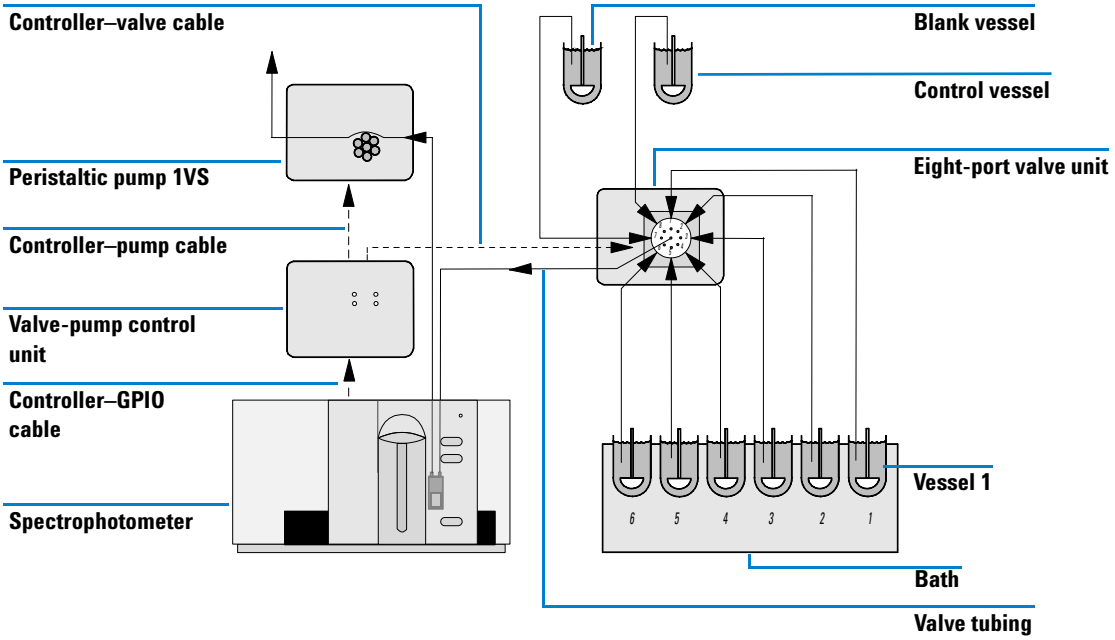


Figure 8 Valve-based Sampling System (G1128A)

To install the valve system you will need the following parts:

- Valve system tubing kit
- Flow cell, 1 mm path length
- Valve-pump controller
- Eight-port valve unit
- Peristaltic pump 1VS

- Controller–GPIO cable
- Controller–valve cable
- Controller–pump cable
- Dissolution probe kit

Setting Up Your Valve-pump Controller

Place the valve-pump controller on a bench, allowing adequate space at rear for access to connectors.

WARNING **Make sure line-power cord is disconnected.**

Each valve-pump controller is identified by a 10-digit serial number on a label attached to the base. Write the serial number of the valve-pump controller here:

_____

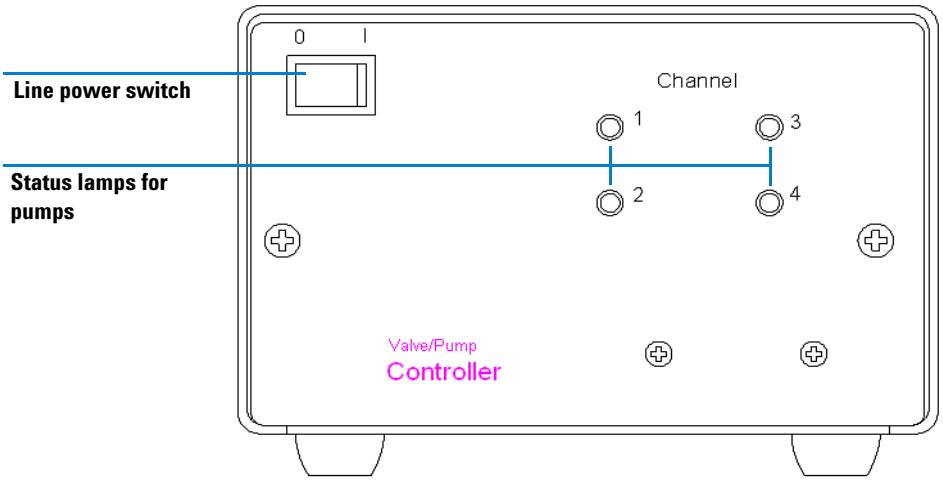


Figure 9 Front View of Valve-Pump Controller

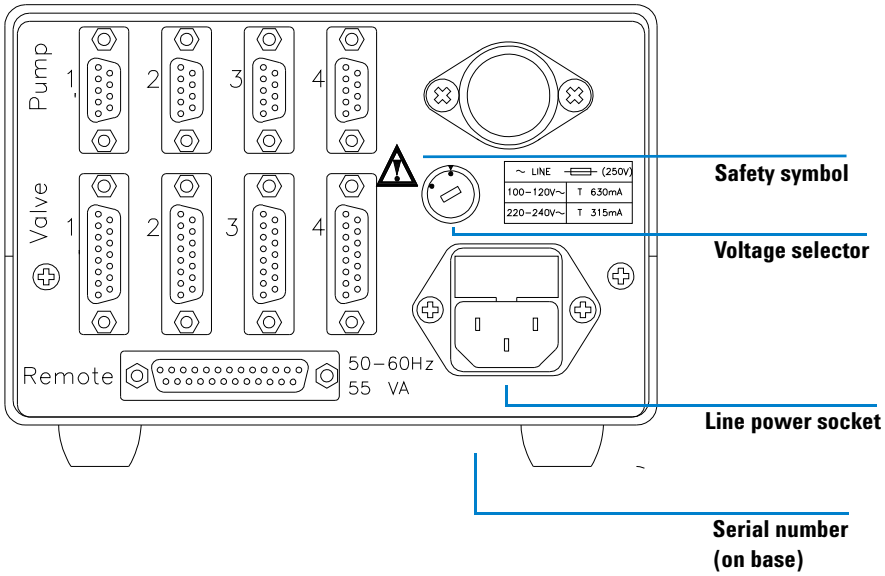


Figure 10 Rear View of Valve-Pump Controller

Selecting Voltage



This safety symbol next to the voltage selector on the rear panel of the valve-pump controller (see Figure 10) indicates you should refer to the following information.

WARNING **Check the line-voltage selector is set to the correct line voltage for operation from your line-power supply, see Figure 10 and Table 11 for details.**

Table 11 Voltage Selection

Power Supply	Select
100–120 V AC	115 V AC
220–240 V AC	230 V AC

WARNING **Make sure line-power cord is disconnected before changing line-voltage setting.**

To change the voltage setting:

1 Insert the tip of small screwdriver in the slot on the voltage selector.

2 Turn the selector to the correct position.

3 Check the correct fuse is installed.

Selecting Fuse

The fuse is behind the cover of the line-power socket. If you change the line-voltage setting, check the correct fuse is installed for the voltage operation you select. See Table 11 on page 39 for the part numbers.

WARNING **Make sure line-power cord is disconnected before installing or replacing a fuse.**

To change a fuse:

1 Insert the tip of small screwdriver under the slot on the cover of the line-power socket to access the fuse.

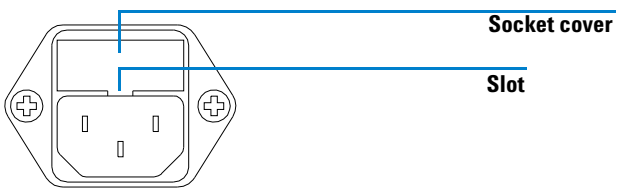


Figure 11 Power Socket of Valve-Pump Controller

2 Use a screwdriver or your finger to lift out the fuse holder.

3 Remove the fuse and replace with a new one. A spare fuse is located in the fuse holder.

4 Replace the fuse holder.

5 Close the socket cover.

Setting Up Your Valve Unit

Place the valve unit on a bench, allowing adequate space at rear for access to connectors. Each valve unit is identified by a 10-digit serial number on a label attached to the rear panel. Write the serial number of the valve unit here:

_____

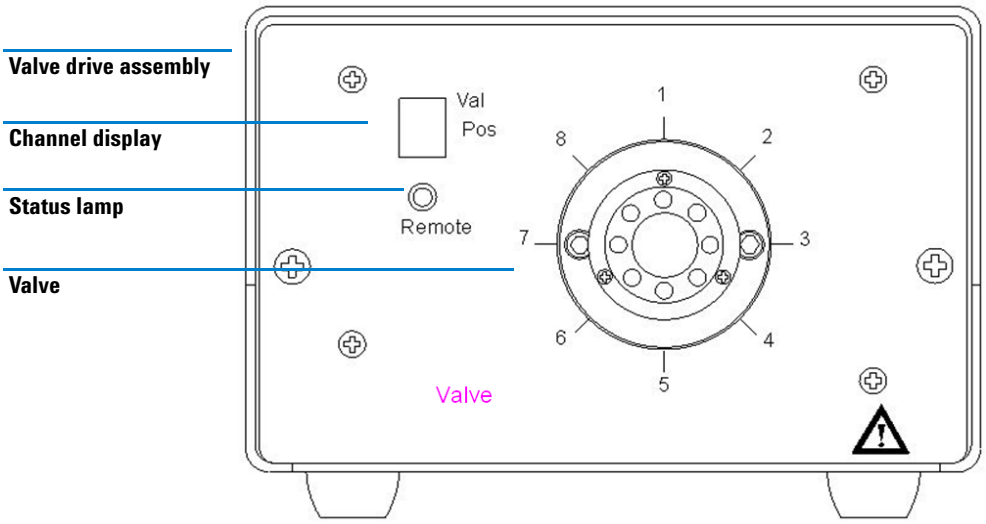


Figure 12 Front View of Valve Unit

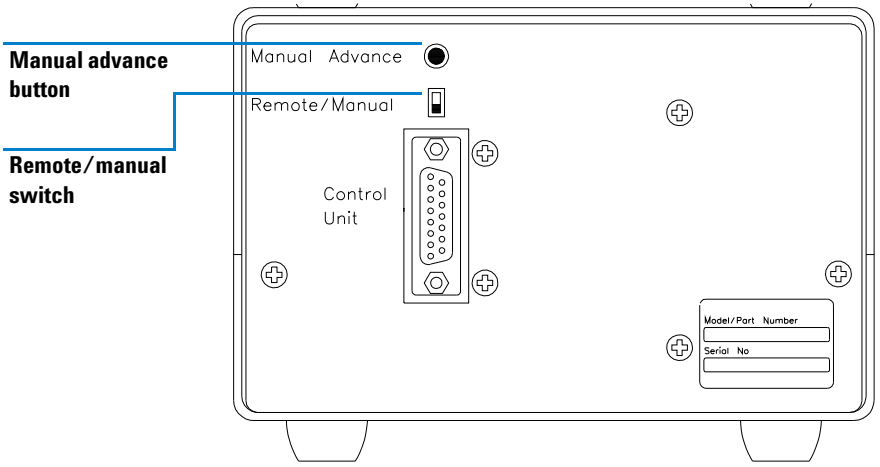


Figure 13 Rear View of Valve Unit

This safety symbol on the front of the valve unit indicates you should refer to the following information.

WARNING **After prolonged use the valve may become contaminated with particulate matter, causing leaks between the rotor and stator. Leaks will appear at the recess on the underside of the valve. Do not place the valve unit above ventilation slits of other electrical appliances. If you are using flammable or toxic solvents, place the valve unit in a safe container.**

Connecting Cables

Check you have the cables shown in Table 12.

Table 12 Cables for Valve Unit and Controller

From Controller:	To Connector:
Power socket	Line-power source
GPIO-to-controller	Agilent 8453 spectrophotometer
Controller-to-Valve 1	Valve unit
Controller-to-Pump 1	Peristaltic pump

The cables connect to the rear panels of the valve-pump controller, valve unit, pump and spectrophotometer.

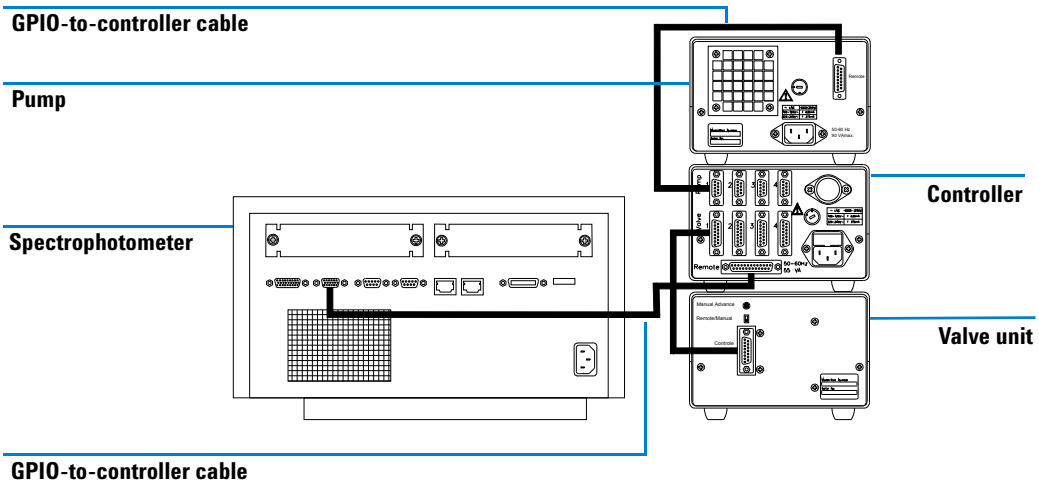


Figure 14 Connecting Cables

The valve-pump controller can control up to four valve units and pumps. You connect the valve unit and its pump to channel 1.

1 Insert the connector of power cord into line power socket of the valve-pump controller.

2 Connect the valve-pump controller to the spectrophotometer using the GPIO-to-controller cable (part number G1103-61610, 1 m). Insert the 25-pin connector of the GPIO-to-controller cable into the remote connector on the valve-pump controller. Connect the 15-pin connector to the GPIO connector of the Agilent 8453 spectrophotometer.

3 Connect the valve unit to the valve-pump controller using the controller-to-valve cable (part number 5062-2407, 2.3 m). Insert the 15 pin connector of the controller-to-valve cable into the valve connector in the valve-pump controller. Insert the 15 pin connector of the controller-to-valve cable into the valve-pump controller connector in the valve unit.

4 Use the controller-to-pump cable (part number G1103-61612, 1 m) to connect the pump to the valve-pump controller. Insert the 9-pin connector of the controller-to-pump cable into the pump connector in the valve-pump controller. Insert the 15-pin connector into the remote connector in the pump.

NOTE Use the same channel number on the valve-pump controller for the valve unit and pump you connect.

More detailed information on using the valve-pump controller and eight-port valve can be found in Chapter 4, “Using the Valve Unit and Valve-pump Controller”.

You set up your dissolution vessels with the probes, see “Dissolution Bath” on page 26.

Installing Your Peristaltic Pump 1VS

Each peristaltic pump 1VS is identified by a serial number on a label at the rear. Write down the serial number of your pump here:

_____

Installing the pump comprises three stages:

- "Stage 1: Installing the Cables" on page 46,
- "Stage 2: Installing the Pump Tubing" on page 47, and
- "Stage 3: Installing the Tubing Cassette" on page 47.

Stage 1: Installing the Cables

The voltage selector and cable connectors are at the rear panel.

WARNING **Make sure line-power cord is disconnected before changing line-voltage setting.**

1. Set the correct voltage option (115 V or 230 V) for operation from your line power supply.
2. Check the correct fuse is installed.
3. Push connector of power cord into line-power socket.
4. Push connector of the controller-pump cable (part number G1103-61612) into the remote control connector on the rear of the pump. When this cable is connected, the control switch on the front panel does not function. This prevents you using the pump manually during automatic operation.
5. You connect the peristaltic pump to the valve-pump controller (use connector marked pump 1) with the controller-pump cable (part number G1103-61612).
6. Set the flow control to 60 for a flow rate of about 8.5 ml/min.

Stage 2: Installing the Pump Tubing

The pump tubing for the pump is 2.06 mm i.d. The pump includes one pack of pump tubing, 12 pieces per pack (part number 5041-2166). There are three fixing-collars on each piece of pump tubing. This allows you to use the pump tubing in two positions.

1 Put the pump tubing in the tubing-cassette, locating the fixing-collars on each side of the cassette in the locating holes. Make sure that the fixing-collars are pointing upwards and the tubing cannot slide out of the cassette.

2 Repeat for each of the cassettes.

Stage 3: Installing the Tubing Cassette

1 Put the tubing cassette on the pressure-wheel assembly by placing the cassette on the mounting pivot, see Figure 15).

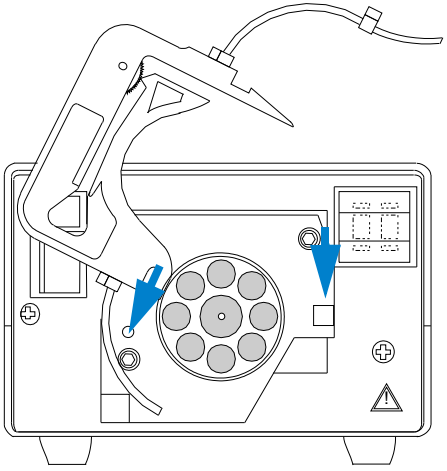


Figure 15 Placing Tubing-Cassette

2 Press the cassette down to lock the right side onto the locking-bar.

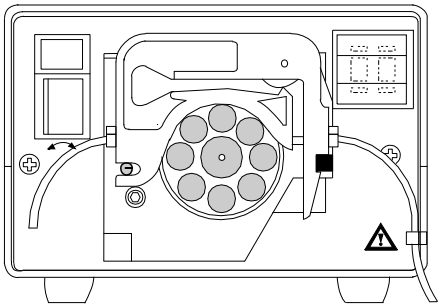


Figure 16 Tubing-Cassette in Position

More detailed information on using the pump can be found in Chapter 3, “Using the Peristaltic Pumps 1VS and 8VS”.

Connecting Valve System Tubing

You use the standard cell holder in the Agilent 8453 spectrophotometer with the valve system. The direction of flow for your samples is from the dissolution vessels through the valve to the flow cell in the cell holder through the pump tubing to waste.

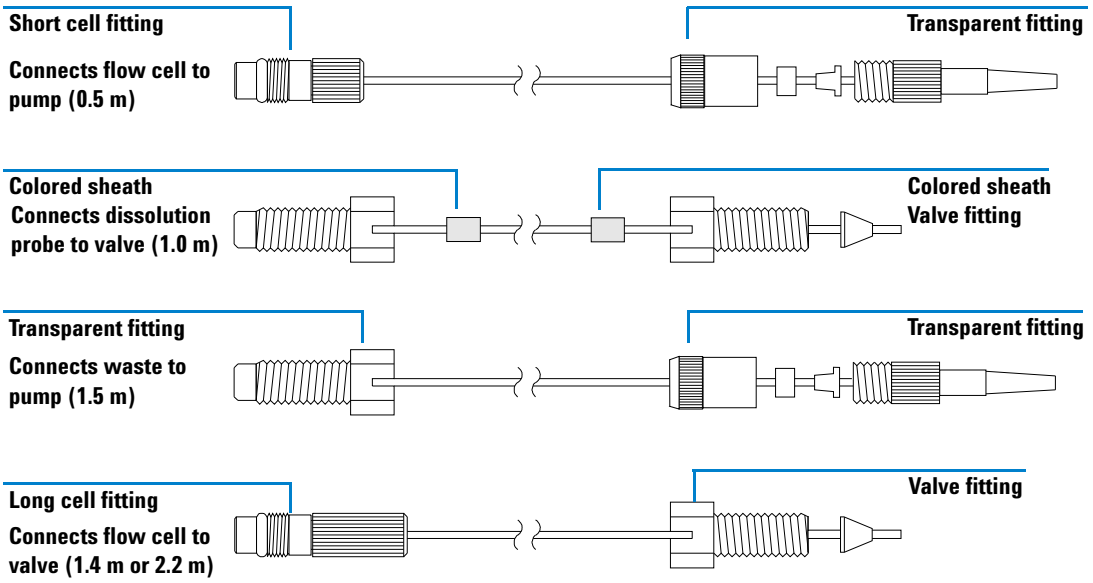


Figure 17 Valve Tubing Kit

The valve tubing kit cell fittings are black and the other fittings are transparent. You identify the different tubing by the fittings, the colored heat-shrunk sheaths and the lengths.

To connect valve system tubing:

1 Insert the flow cell into the standard cell holder in the Agilent 8453 spectrophotometer.

2 Connect the dissolution probes to the valve unit, see Figure 7 on page 33 and Chapter 4, “Using the Valve Unit and Valve-pump Controller”. Connect the 1.5 m pre assembled tubing with colored heat-shrunk sheaths to the union attached to the dissolution probe. Connect the tubing with colored heat-shrunk sheaths to the valve inlets.

3 Connect the flow cell to the pump, see Figure 6 on page 32. Connect the 0.5 m tubing with the short cell fitting to the outlet of the flow cell, and insert the conical adapter into the pump tubing on the inlet side of the pump.

4 Connect the valve unit to the flow cell. Connect the 1.4 m or 2.2 m tubing with the long cell fitting to the inlet (marked with ↓) of the flow cell. Connect the valve fitting to the valve outlet.

NOTE To minimize carry over, use the 1.4 m tubing.

5 Connect pump to waste. Insert the conical adapter into the pump tubing on the outlet side of the pump and put the transparent fitting into a waste beaker.

Replacing Tubing

General instructions for attaching new fittings to tubing are provided in a replacement PTFE tubing kit (part number 5041-2191). This kit contains 10 m of PTFE tubing.

Troubleshooting

Table 13 Troubleshooting Valve-based Sampling Systems

Problem	Action
Invalid or unusual spectrum caused by sticky bubbles in flow cell.	Sticky bubbles on the window of the flow cell can be minimized by cleaning the tubing and flow cell with a solution of 2% passivating and cleaning fluid (part number 5062-8529).
Invalid or unusual spectrum caused by bubbles in the flow cell moving up through the light path during measurement.	Specify a longer cycle time (7.5 or 10 minutes) to increase the pump and wait time. Use flow cells with a wide aperture.
Cross contamination.	Check the flow rate of the pump and replace the pump tubing if necessary. Specify a longer cycle time (7.5 or 10 minutes) to increase the pump time. Adjust the speed control of the peristaltic pump to a higher speed. Check tubing for possible flow restrictions. Use a flow cell with a smaller inner volume.
Extensive bubbles in tubing.	Check tubing for possible air leaks. Check surfaces of the ferrules and exchange ferrules which are scratched. Tighten fittings and unions. Check the fittings at the valve heads. Change filter tips and/or use filter tips with a wider pore size, if appropriate.
Leaking valve.	Check your valve according to the procedure given in Chapter 4, “Using the Valve Unit and Valve-pump Controller”.

Part Numbers

Table 14 Ordering Information for Replacement Parts and Tubing Kits*

Description	Part Number
Peristaltic pump 1VS, 230 V	G1103-60004
Peristaltic pump 1VS, 115 V	G1103-60006
Valve/Pump controller, 115 V	89078-60001
Valve/Pump controller, 230 V	89078-60002
Valve drive, 50Hz	89079-60002
Valve drive, 60Hz	89079-60003
Valve head	5063-6575
Valve rotor seal	5067-1539
Controller-GPIO cable	G1103-61610
Controller-valve cable	5062-2407
Controller-pump cable	G1103-61612
Filter tips (pack of 1000)	5181-1246
Flow cell, 1 mm path length	5063-6570
Valve system tubing kit†	5042-1331
Peristaltic pump tubing, 2.06 mm inner diameter (12)	5041-2166
Dissolution probe kit‡	5042-1332
Teflon tubing kit, 0.8 mm inner diameter, 1.6 mm outer diameter (10 m)	5041-2191

* For part numbers of cell fittings and ferrules, tubing fittings, ferrules, conical adapters and unions, see the UV-visible section of Agilent's *Accessories and Supplies for UV-visible Spectroscopy* Catalog.

† Supplied with pre assembled tubing and fittings.

‡ Supplied pre assembled.

See Table 7 on page 23 for details of fittings.

Installing Your Multibath System

The multibath system comprises up to four valve-based sampling systems in combination with a multicell transport. Each of the baths is connected to an eight-port stream-selection valve to sample up to eight vessels sequentially. The multicell transport holds a flow cell for each bath and moves the flow cell of the bath currently being sampled into the light path. Each time a sample is taken a certain amount of dissolution medium is lost to waste.

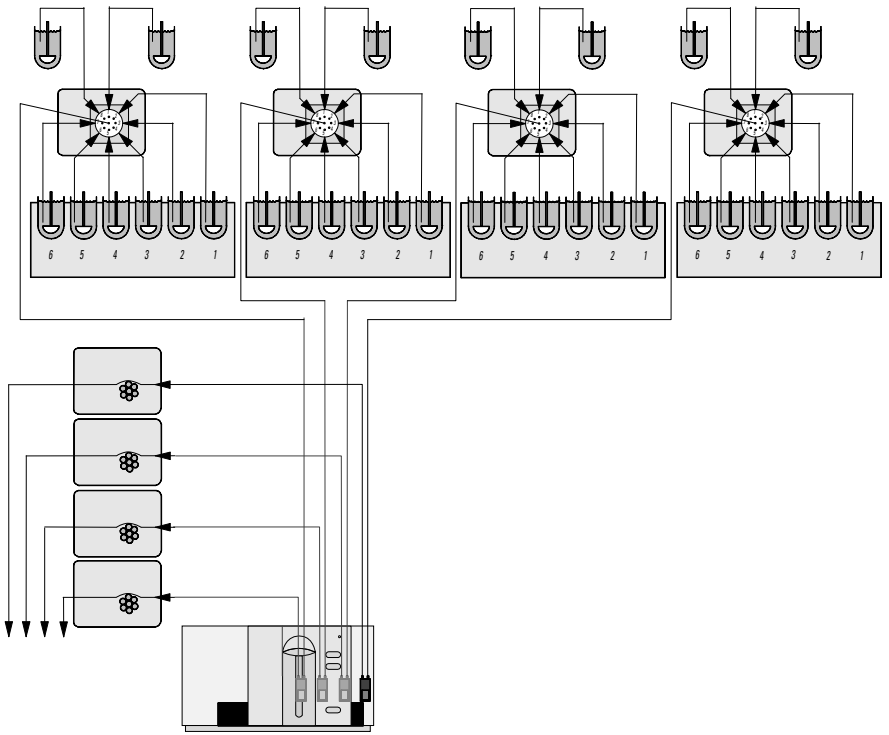


Figure 18 Multibath System (G1129A)

To install the multibath sampling system for two baths (G1129A) you will need the following parts:

- Multicell transport
- Flow cell, 1 mm path length (2)
- Valve-pump controller
- Eight-port valve unit (2)
- Peristaltic pump 1VS (2)
- Controller–GPIO cable
- Controller-–valve cable (2)
- Controller–pump cable (2)
- Dissolution probe kit (2)
- Valve tubing kit (2)
- Pump tubing (2)
- Filter tips (2)

Installing Your Multicell Transport

For details, see *Installing and Operating Your Eight-position Multicell Transport* manual.

Setting Up Your Valve-pump Controller

Place the valve-pump controller on a bench, allowing adequate space at rear for access to connectors.

WARNING **Make sure line-power cord is disconnected.**

Each valve-pump controller is identified by a 10-digit serial number on a label attached to the base. Write the serial number of the valve-pump controller here:

_____

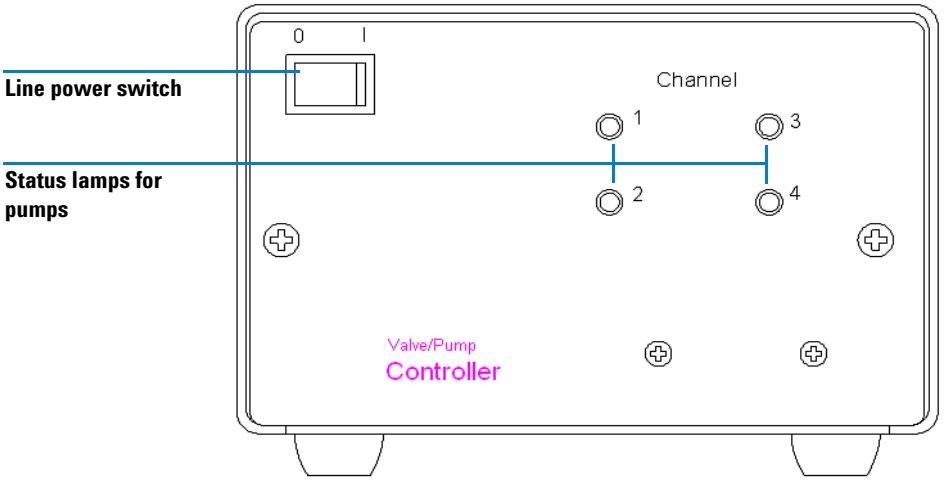


Figure 19 Front View of Valve-Pump Controller

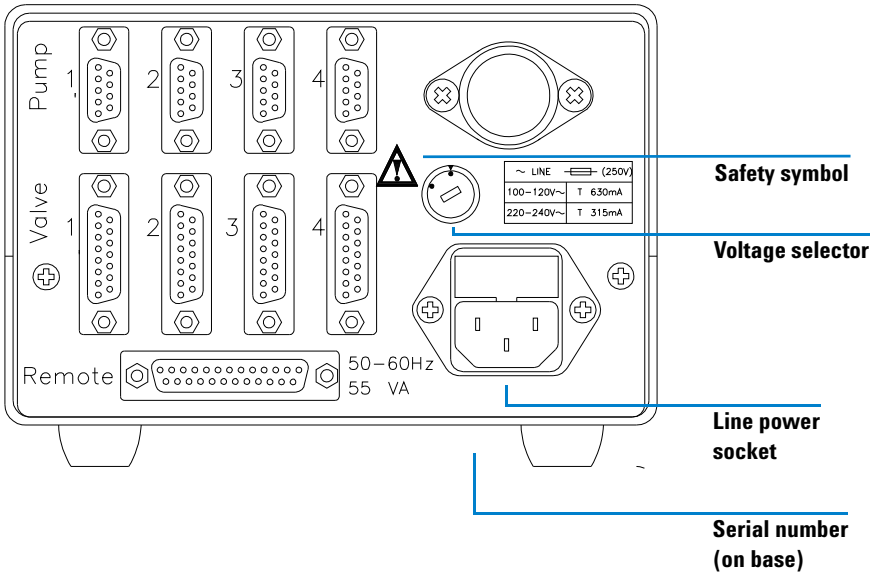


Figure 20 Rear View of Valve-Pump Controller

Selecting Voltage



This safety symbol next to the voltage selector on the rear panel of the valve-pump controller (see Figure 20) indicates you should refer to the following information.

WARNING **Check the line-voltage selector is set to the correct line voltage for operation from your line-power supply, see Figure 10 and Table 11 for details.**

Table 15 Voltage Selection

Power Supply	Select
100–120 V AC	115 V AC
220–240 V AC	230 V AC

WARNING **Make sure line-power cord is disconnected before changing line-voltage setting.**

To change the voltage setting:

1 Insert the tip of small screwdriver in the slot on the voltage selector.

2 Turn the selector to the correct position.

3 Check the correct fuse is installed.

Selecting Fuse

The fuse is behind the cover of the line-power socket. If you change the line-voltage setting, check the correct fuse is installed for the voltage operation you select. See Table 11 on page 39 for the part numbers.

WARNING **Make sure line-power cord is disconnected before installing or replacing a fuse.**

To change a fuse:

1 Insert the tip of small screwdriver under the slot on the cover of the line-power socket to access the fuse.

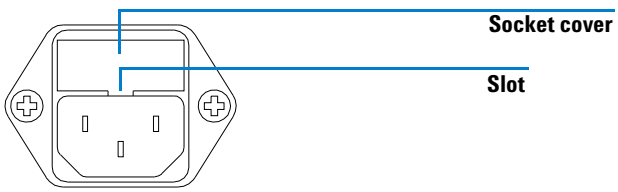


Figure 21 Power Socket of Valve-Pump Controller

2 Use a screwdriver or your finger to lift out the fuse holder.

3 Remove the fuse and replace with a new one. A spare fuse is located in the fuse holder.

4 Replace the fuse holder.

5 Close the socket cover.

Setting Up Your Valve Units

Place the valve units on a bench, allowing adequate space at rear for access to connectors. Each valve unit is identified by a 10-digit serial number on a label attached to the rear panel. Write the serial numbers of the valve units here:

1.)_____

2.)_____

3.)_____

4.)_____

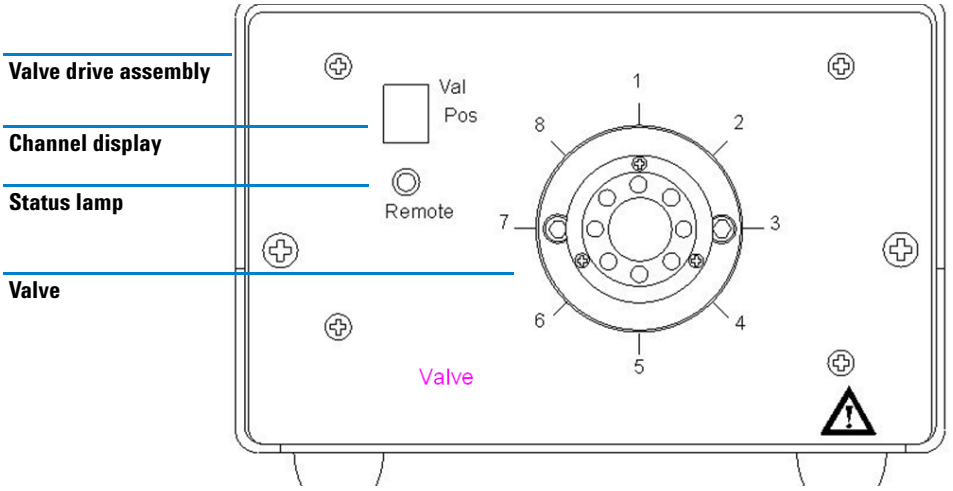


Figure 22 Front View of Valve Unit

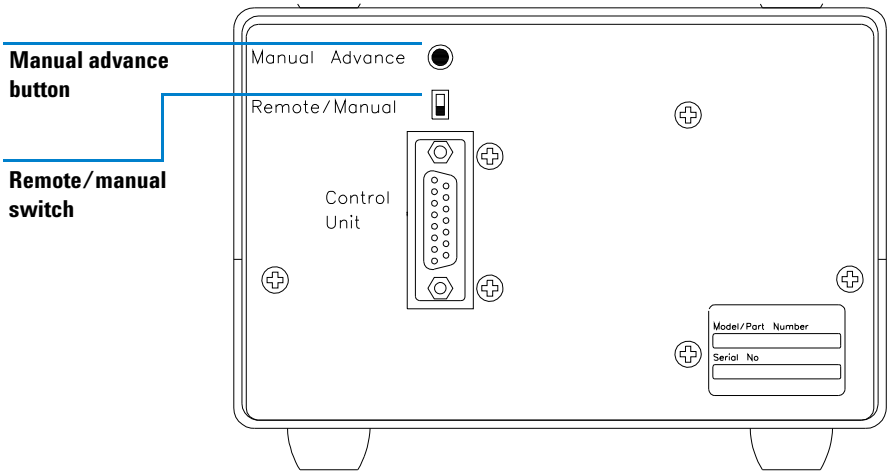


Figure 23 Rear View of Valve Unit

This safety symbol on the front of the valve unit indicates you should refer to the following information.

WARNING **After prolonged use the valve may become contaminated with particulate matter, causing leaks between the rotor and stator. Leaks will appear at the recess on the underside of the valve. Do not place the valve unit above ventilation slits of other electrical appliances. If you are using flammable or toxic solvents, place the valve unit in a safe container.**

Connecting Cables

Check you have the cables shown in Table 12.

Table 16 Cables for Valve Unit and Controller

From Controller:	To Connector:
Power socket	Line-power source
GPIO-to-controller	Agilent 8453 spectrophotometer
Controller-to-Valve 1 through 4	Valve units
Controller-to-Pump 1 through 4	Peristaltic pumps

The cables connect to the rear panels of the valve-pump controller, valve units, pumps and spectrophotometer.

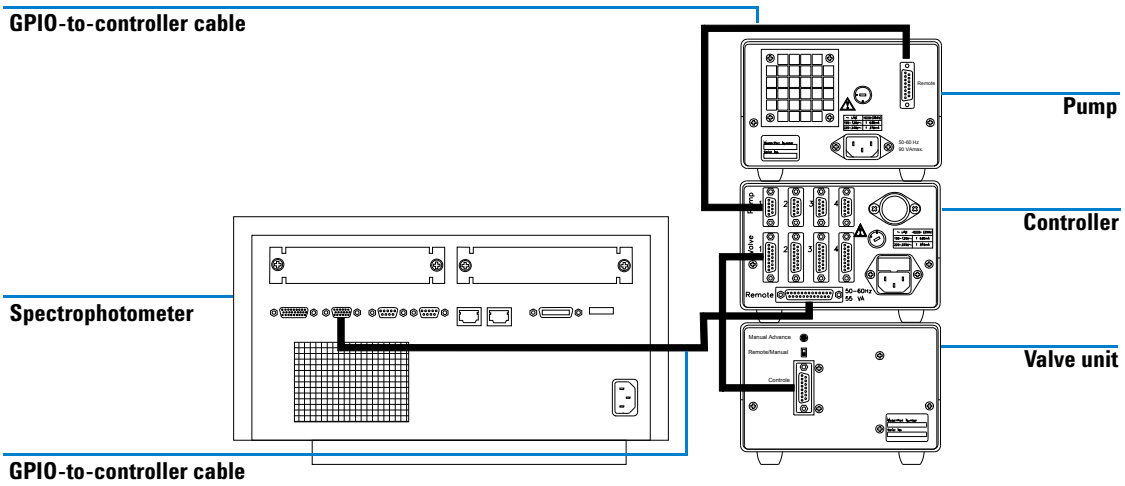


Figure 24 Connecting Cables

The valve-pump controller can control up to four valve units and pumps. You connect the valve unit and its pump to the same channel.

1 Insert the connector of power cord into line power socket of the valve-pump controller.

2 Connect the valve-pump controller to the spectrophotometer using the GPIO-to-controller cable (part number G1103-61610, 1 m). Insert the 25-pin connector of the GPIO-to-controller cable into the remote connector on the valve-pump controller. Connect the 15-pin connector to the GPIO connector of the Agilent 8453 spectrophotometer.

3 Connect the valve unit to the valve-pump controller using the controller-to-valve cable (part number 5062-2407, 2.3 m). Insert the 15 pin connector of the controller-to-valve cable into the valve connector in the valve-pump controller. Insert the 15 pin connector of the controller-to-valve cable into the valve-pump controller connector in the valve unit.

4 Use the controller-to-pump cable (part number G1103-61612, 1 m) to connect the pump to the valve-pump controller. Insert the 9-pin connector of the controller-to-pump cable into the pump connector in the valve-pump controller. Insert the 15-pin connector into the remote connector in the pump.

NOTE Use the same channel number on the valve-pump controller for the valve unit and pump you connect.

More detailed information on using the valve-pump controller and eight-port valve can be found in Chapter 4, “Using the Valve Unit and Valve-pump Controller”.

You set up your dissolution vessels with the probes, see “Dissolution Bath” on page 26.

Installing Your Peristaltic Pump 1VS

Each peristaltic pump 1VS is identified by a serial number on a label at the rear. Write down the serial numbers of your pumps here:

1.)_____

2.)_____

3.)_____

4.)_____

Installing each pump comprises three stages:

- "Stage 1: Installing the Cables" on page 62,
- "Stage 2: Installing the Pump Tubing" on page 63, and
- "Stage 3: Installing the Tubing Cassette" on page 64.

Stage 1: Installing the Cables

The voltage selector and cable connectors are at the rear panel.

WARNING **Make sure line-power cord is disconnected before changing line-voltage setting.**

1 Set the correct voltage option (115 V or 230 V) for operation from your line power supply.

2 Check the correct fuse is installed.

3 Push connector of power cord into line-power socket.

4 Push connector of the controller-pump cable (part number G1103-61612) into the remote control connector on the rear of the pump. When this cable is connected, the control switch on the front panel does not function. This prevents you using the pump manually during automatic operation.

5 You connect the peristaltic pump to the valve-pump controller with the controller-pump cable (part number G1103-61612).

6 Set the flow control to 40 for a flow rate of about 6.5 ml/min.

Stage 2: Installing the Pump Tubing

The pump tubing for the pump is 2.06 mm i.d. The pump includes one pack of pump tubing, 12 pieces per pack (part number 5041-2166). There are three fixing-collars on each piece of pump tubing. This allows you to use the pump tubing in two positions.

1 Put the pump tubing in the tubing-cassette, locating the fixing-collars on each side of the cassette in the locating holes. Make sure that the fixing-collars are pointing upwards and the tubing cannot slide out of the cassette.

2 Repeat for each of the cassettes.

Stage 3: Installing the Tubing Cassette

1 Put the tubing cassette on the pressure-wheel assembly by placing the cassette on the mounting pivot, see Figure 25).

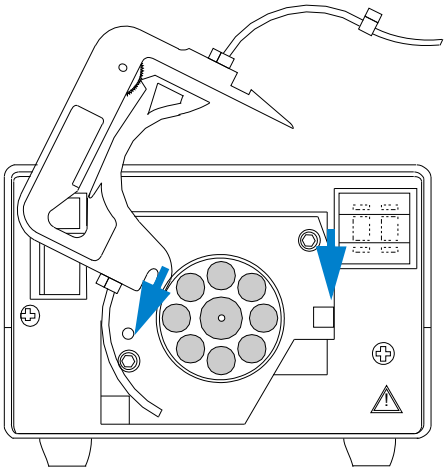


Figure 25 Placing Tubing-Cassette

2 Press the cassette down to lock the right side onto the locking-bar.

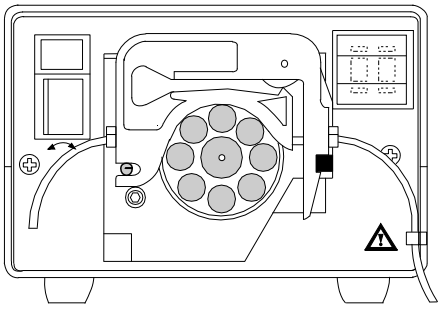


Figure 26 Tubing-Cassette in Position

More detailed information on using the pump can be found in Chapter 3, “Using the Peristaltic Pumps 1VS and 8VS”.

Connecting Valve System Tubing

You use the multicell transport in the Agilent 8453 spectrophotometer with the valve-based multibath system. The direction of flow for your samples is from the dissolution vessels through the valve to the flow cell in the cell holder through the pump tubing to waste.

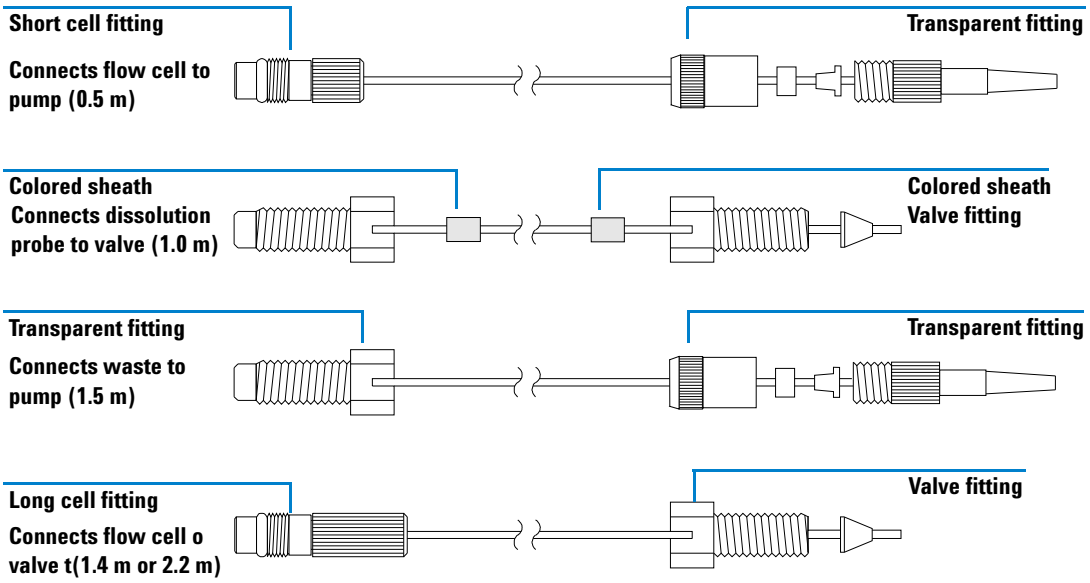


Figure 27 Valve Tubing Kit

You identify the different tubing by the fittings and the lengths.

To connect valve system tubing:

1. Insert the flow cell into position 1 to 4 (depending on the number of the bath) of the multicell transport in the Agilent 8453 spectrophotometer.
2. Connect the dissolution probes to the valve unit, see Figure 7 on page 33 and Chapter 4, “Using the Valve Unit and Valve-pump Controller”. Connect the 1.5 m pre assembled tubing with colored heat-shrunk sheaths to the union attached to the dissolution probe. Connect the tubing with colored heat-shrunk sheaths to the valve inlets.

3 Connect the flow cell to the pump, see Figure 6 on page 32. Connect the 0.5 m tubing with the short cell fitting to the outlet of the flow cell, and the fitting to a union. Connect a conical adapter to the union. Insert the conical adapter into the pump tubing on the inlet side of the pump.

4 Connect the valve unit to the flow cell. Connect the 1.4 m or 2.2 m tubing with the long cell fitting to the inlet (marked with ↓) of the flow cell. Connect the valve fitting to the valve outlet.

NOTE To minimize carry over, use the 1.4 m tubing.

5 Connect pump to waste. Insert the conical adapter into the pump tubing on the outlet side of the pump and put the transparent fitting into a waste beaker.

6 Repeat step 1 through step 5 for the other baths.

Replacing Tubing

General instructions for attaching new fittings to tubing are provided in a replacement PTFE tubing kit (part number 5041-2191). This kit contains 10 m of PTFE tubing.

Troubleshooting

Table 17 Troubleshooting Valve-based Sampling Systems

Problem	Action
Invalid or unusual spectrum caused by sticky bubbles in flow cell.	Sticky bubbles on the window of the flow cell can be minimized by cleaning the tubing and flow cell with a solution of 2% passivating and cleaning fluid (part number 5062-8529).
Invalid or unusual spectrum caused by bubbles in the flow cell moving up through the light path during measurement.	Specify a longer cycle time (7.5 or 10 minutes) to increase the pump and wait time. Use flow cells with a wide aperture.
Cross contamination.	Check the flow rate of the pump and replace the pump tubing if necessary. Specify a longer cycle time (7.5 or 10 minutes) to increase the pump time. Adjust the speed control of the peristaltic pump to a higher speed. Check tubing for possible flow restrictions. Use a flow cell with a smaller inner volume.
Extensive bubbles in tubing.	Check tubing for possible air leaks. Check surfaces of the ferrules and exchange ferrules which are scratched. Tighten fittings and unions. Check the fittings at the valve heads. Change filter tips and/or use filter tips with a wider pore size, if appropriate.
Leaking valve.	Check your valve according to the procedure given in Chapter 4, “Using the Valve Unit and Valve-pump Controller”.

Part Numbers

Table 18 Ordering Information for Replacement Parts and Tubing Kits*

Description	Part Number
Eight-position multicell transport	G1120A
Peristaltic pump 1VS, 230 V	G1103-60004
Peristaltic pump 1VS, 115 V	G1103-60006
Valve/Pump controller, 115 V	89078-60001
Valve/Pump controller, 230 V	89078-60002
Valve drive, 50Hz	89079-60002
Valve drive, 60Hz	89079-60003
Valve head	5063-6575
Valve rotor seal	5067-1539
Controller-GPIO cable	G1103-61610
Controller-valve cable	5062-2407
Controller-pump cable	G1103-61612
Filter tips (pack of 1000)	5181-1246
Flow cell, 1 mm path length	5067-6570
Valve tubing kit†	5042-1331
Peristaltic pump tubing, 2.06 mm inner diameter (12)	5041-2166
Dissolution probe kit‡	5042-1332
Teflon tubing kit, 0.8 mm inner diameter, 1.6 mm outer diameter (10 m)	5041-2191

* For part numbers of cell fittings and ferrules, tubing fittings, ferrules, conical adapters and unions, see the UV-visible section of Agilent's *Accessories and Supplies for UV-visible Spectroscopy* Catalog.

† Supplied with pre assembled tubing and fittings.

‡ Supplied pre assembled.

See Table 7 on page 23 for details of fittings.

3
Using the Peristaltic Pumps 1VS and 8VS

Operating Your Pump 73
Maintaining Your Pump 74
Servicing Your Pump 80

Installing Your Pump

The peristaltic pumps 1VS and 8VS are for one and eight pumping channels. The pumps are designed for liquid samples. Due to the peristaltic pump principle only the tubing is in contact with the liquid.

The pumps can be operated manually and remotely via a digital interface. If used for automated sampling in the dissolution testing application, only the remote operation is applied.

Table 1 on page 15 shows the Physical Specifications Peristaltic Pumps 1VS and 8VS and Table 2 on page 16 shows the Performance Specifications Peristaltic Pumps 1VS and 8VS.

The pump operates on 100–120 V AC or 220–240 V AC and delivers flow up to 14 ml/min and 2 bar from each channel. The pump has a pressure-wheel assembly for one or eight tubing-cassettes. The pump can be remotely controlled to start and stop, and change direction, or it can be operated manually from the front panel.

Viewing the Pump

The pump has three functional parts:

- controls,
- cable connectors, and
- cassettes.

Controls

The front panel controls are a line power switch, a three-position control switch, a flow control switch, and a safety symbol. See Figure 28.

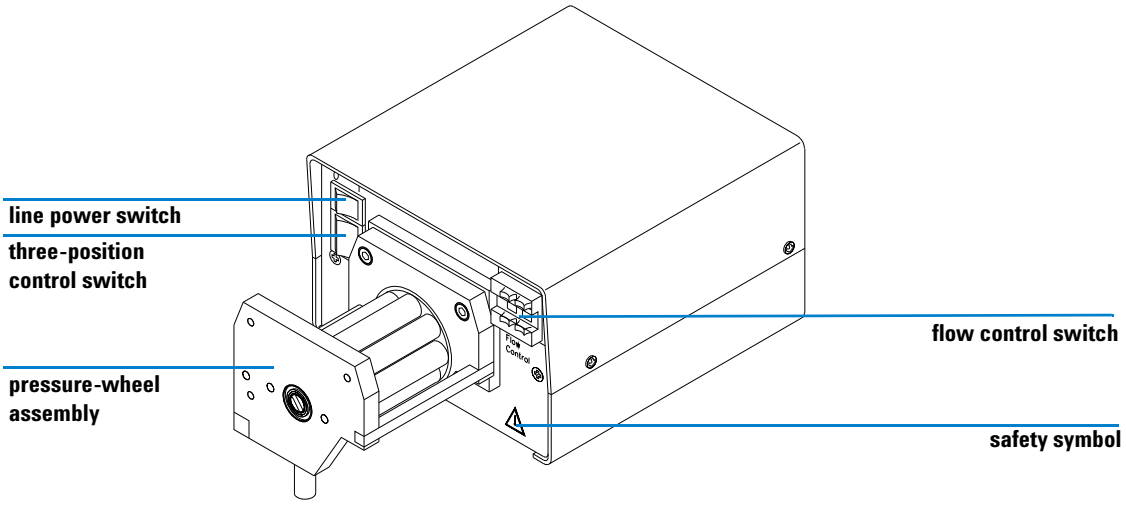


Figure 28 Front View of the Pump

The pressure-wheel assembly for the tubing-cassettes is on the front of the pump.

WARNING **Do not touch the pressure-wheel assembly when it is turning. Your fingers may become trapped.**



The safety symbol indicates a potential hazard to the user and pump during operation.

Cable Connectors

The rear panel has a power socket, a remote cable connector, a line voltage selector, and a fan outlet. See Figure 29.

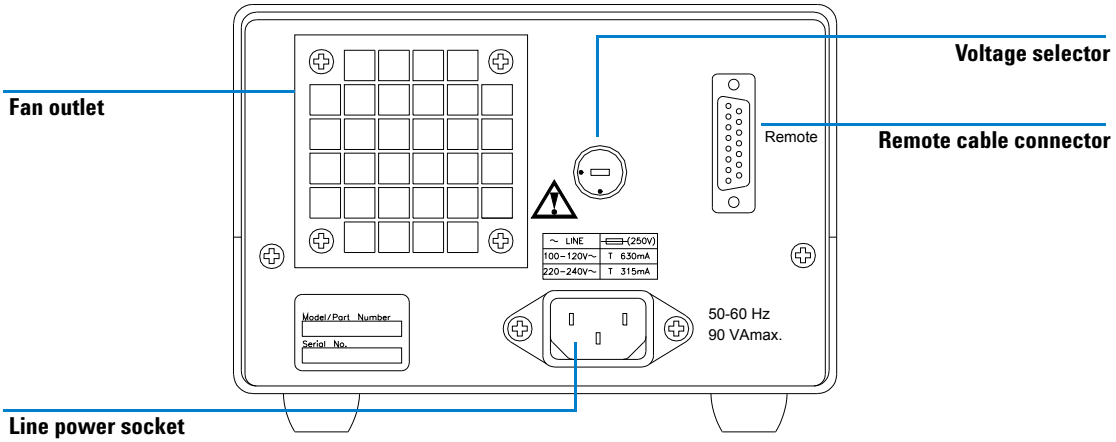


Figure 29 Rear View of the Pump

Cassettes

The tubing-cassette has automatic pressure control, and slots for the tubing with locating holes for the fixing-collars. See Figure 30.

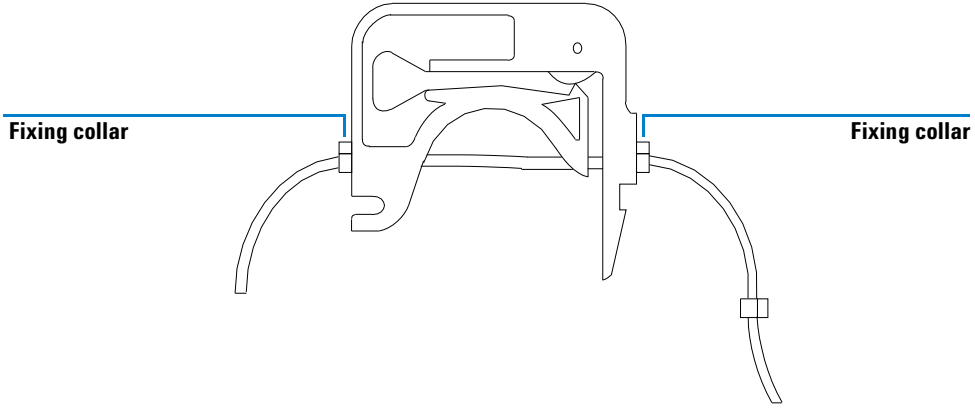


Figure 30 Tubing-Cassette

Operating Your Pump

You may operate the pump remotely or manually with or without the peristaltic pump remote cable. Before using the pump with the remote cable adjust the flow rate as described in "Adjusting Flow Rate" on page 73.

Adjusting Flow Rate

1. Remove the peristaltic pump remote cable from the remote connector at the rear of the pump.
2. Turn on the line power at the line switch on the front of the pump.
3. Place the left end of the tubing in a reservoir of liquid.
4. Place the right end of the tubing in a empty waste beaker.
5. Press the control switch on the front panel to the right to pump clockwise.
6. Set the flow control to about 40.
7. Change the flow setting for the desired flow rate according to Table 19.

Table 19 Flow Settings

Flow Setting	Approximate Flow Rate (Water)
40	6.0 ml/min
60	8.5 ml/min
80	11.5 ml/min

8. Reconnect the peristaltic pump remote cable to the remote connector to enable remote operation from the Agilent 8453 spectrophotometer.

For operating the pump through the peristaltic pump remote cable from the Agilent 8453 spectrophotometer, see the appropriate manual.

Maintaining Your Pump

This chapter describes the maintenance tasks that you can do on your pump. Maintenance of the pump is divided into four parts:

- "Removing the Tubing Cassette" on page 75.
- "Changing the Pressure-wheel Assembly" on page 75.
- "Changing the Drive Belt" on page 77.
- "Changing the Fuse" on page 79.

Order numbers for replacing parts are shown in Table 20.

Table 20 Replacement Parts

Description	Part Number
Peristaltic pump tubing, 2.06 mm inner diameter (12)	5041-2166
Cassette (with spring, fixed pressure)	5041-2167
Cassette (variable pressure)	5042-1356
Controller-to-pump cable	G1103-61612
GPIO -to-pump cable	G1103-61607
Peristaltic pump drive assembly, 115 V	89092-69001
Peristaltic pump drive assembly, 230 V	89092-69002
Peristaltic pump pressure-wheel assembly 8 channel	89092-60003
Drive belt	89092-60004
T500 mA fuse for 230 V AC operation	2110-0458
T1 A fuse for 115 V AC operation	2110-0457

Removing the Tubing Cassette

You may want to change the pump tubing for different applications, or when it becomes worn. You must remove the tubing cassette to change the tubing.

WARNING **Make sure the line-power cord is disconnected before removing the tubing-cassettes.**

1 Release the tubing cassette from the right side of the pressure wheel by pressing the snap-lock lever to the left and upwards of the locking-bar.

2 Remove the tubing cassette from the mounting pivot on the left side of the pressure wheel by lifting upwards.

3 Remove pump tubing—release the fixing collars on each side of the cassette from the locating holes and slide the tubing out of the cassette.

See "Stage 1: Installing the Cables" on page 28 for replacing the tubing, and "Stage 3: Installing the Tubing Cassette" on page 30 for replacing the tubing-cassette.

Changing the Pressure-wheel Assembly

It may be necessary to replace the pressure-wheel assembly when it becomes worn or damaged. Also there are a number of reasons why it may be necessary to replace the drive assembly:

- a new fuse blows immediately,
- the pump does not work in manual operation, or
- the pumping speed is not steady.

Removing the Pressure-Wheel Assembly

See Table 20 on page 74 for the part numbers for exchanging the pressure-wheel assembly and drive assembly. For exchanging either part you remove the pressure-wheel assembly. You require a 3 mm hex key to remove pressure wheel.

1 Remove the tubing cassettes, see “Removing the Tubing Cassette” on page 75.

2 See Figure 31 for the position of the screw holes to aid in locating the screws. Using a 3 mm hex key, unscrew the three screws holding the pressure-wheel assembly to the front of the pump.

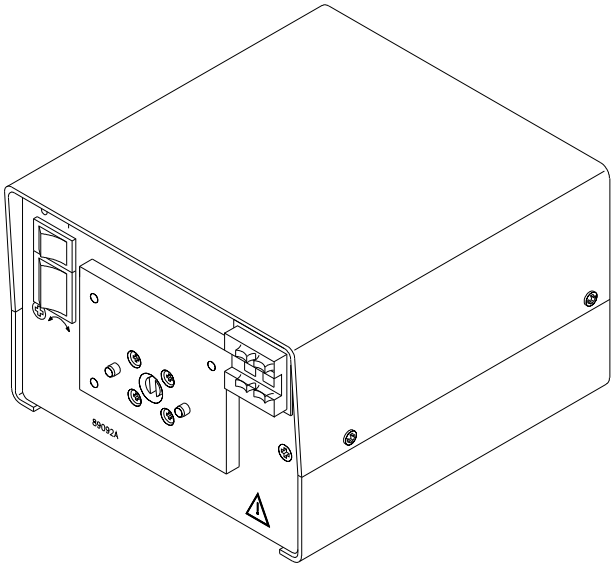


Figure 31 Pump with the Pressure-Wheel Assembly Removed

3 Pull the pressure-wheel assembly from the front mounting.

Replacing the Pressure-wheel Assembly

1 Place the pressure-wheel assembly on the front mounting. You may need to use a flat-tip screwdriver to turn the drive shaft of the pressure-wheel assembly to align it with the flange in the front of the power housing.

2 Screw the three screws through the pressure-wheel assembly to the front of the pump, using a 3 mm hex key.

Changing the Drive Belt

If the pressure wheel does not rotate the drive belt may be broken. If the speed is not steady the drive belt may be worn. You must change the drive belt if it is broken or worn. You require a Phillips screwdriver to remove the screws on the cover and a slot screwdriver to remove the drive belt.

To change the drive belt you remove the pressure-wheel assembly, the pump housing cover, and the gear-box mounting-plate.

1 Remove the pressure-wheel assembly, see "Changing the Pressure-wheel Assembly" on page 75.

2 Remove the pump housing cover—using a Phillips screwdriver, unscrew the four screws which hold the pump housing top cover, as shown in Figure 32, then lift the cover upwards to remove the top cover.

WARNING **Electronic boards and components are sensitive to electrostatic discharge (ESD). To prevent damage always use an ESD protection (for example, an ESD wrist strap) when handling electronic boards and components.**

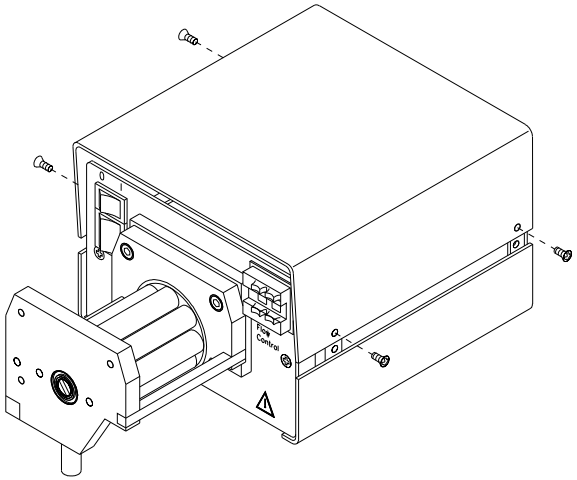


Figure 32 Lifting Pump Housing Cover

3 Remove gear box mounting-plate—see Figure 31 on page 76 for the position of the screws holes to aid in locating the screws. Using a Phillips screwdriver, unscrew the four screws holding the gear box mounting-plate to the front of the pump. This releases the gear box and drive belt from the front panel.

Removing Drive Belt

1 Using a slot screwdriver, push the drive belt off the toothed-drive wheel (Figure 33), at the same time turning the toothed-drive wheel of the gear box (Figure 33).

2 Remove the drive belt from the toothed-wheel of the gear box.

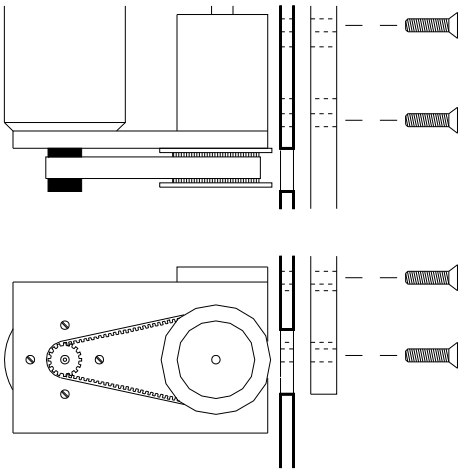


Figure 33 Drive Belt of the Pump

Replacing Drive Belt

1 Put the drive belt (part number 89092-60004) over the toothed-wheel of the gear box.

2 Push the drive belt onto the toothed-drive wheel, at the same time turning the toothed-drive wheel of the gear box.

3 Replace the gear box mounting-plate. Check Figure 31 on page 76 for the correct positioning of the plate.

4 Screw the four screws into the gear box mounting-plate, using a Phillips screwdriver.

5 Replace the pump housing cover.

6 Screw the four screws into the top cover, using a Phillips screwdriver, see Figure 32 on page 77.

7 Replace the pressure-wheel assembly, see "Replacing the Pressure-wheel Assembly" on page 76.

Changing the Fuse

If your pump does not work, check the fuse. The fuse is behind the power socket. Remove the fuse cover to access the fuse. See Table 20 on page 74 for the part numbers. Select the correct fuse for the voltage setting you use.

WARNING **Make sure line-power cord is disconnected before installing or replacing a fuse.**

1 Use a screwdriver to open the fuse cover.

2 Remove the fuse and replace with a new one.

3 Close the fuse cover.

Servicing Your Pump

This chapter is for Agilent Technologies service personnel. It contains a description of the electronics and procedure for checking remote operation of the pump.

Electronics Description

A description of the parts in Figure 34 follows in the next sections.

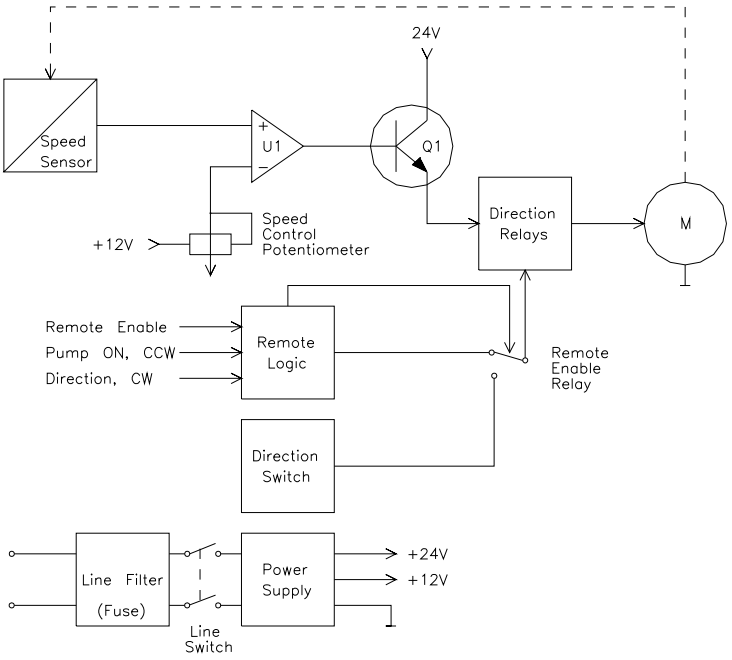


Figure 34 Pump Drive Electronics

Pump Drive Electronics

- Speed Control Potentiometer

  The speed control potentiometer gives a set point for the motor speed to the operational amplifier U1. The numbers on the potentiometers are in arbitrary units.

- Speed Sensor

  The speed sensor consists of a speed generator and an amplifier. The voltage produced is proportional to the cycles of the motor.

- Amplifier U1, Transistor Q1, Direction Relays, Motor M

  The voltages from the speed control potentiometer are compared with the speed sensor and the result is used to drive the 24 V DC motor M (through Q1 and the direction relays).

- Remote Logic, Remote Enable Relay

  For remote operation connecting the remote cable to the pump automatically pulls the remote enable line to ground. When this occurs the remote logic connects to the direction relays and the remote lines are used to control the pump. When Pump on, CCW line is pulled to ground the pump turns on in a counterclockwise direction. In addition, when the Direction, CW line is also pulled to ground the pump turns on in a clockwise direction.

  For the pin connections see Table 22 on page 84.

- Direction Switch

  For manual operation the direction switch, on the front panel, controls the direction of the pump through the direction relays. This switch is operational only when the remote cable is not connected.

Power Supply

The line voltage connects to the line filter, which contains a line fuse. The line voltage feeds through the line switch into the power supply which contains a transformer, rectifier and regulation circuits. A linear voltage regulator controls the + 12 V DC line.

Access to the **line fuse** in the line filter is from the rear of the instrument.

T500 mA (part number 2110-0458) for 230 V AC operation.

T1 A (part number 2110-0457) for 115 V AC operation.

Checking Remote Operation

There are three different parts to check the remote operation of the pump:

- Remote cable
- Remote cable connector on pump
- Wiring of remote cable

Remote Cable

To check the switching capability of the remote plug:

1. Remove the peristaltic pump remote cable from the remote connector on the rear of the pump.
2. Allow the pump to operate:
   a. Turn on the pump.
   b. Select a direction for pumping by pressing the switch.
   c. Set the flow control switch to a value greater than zero.
3. Reconnect the peristaltic pump remote cable, the operation of the pump stops.

Remote Cable Connector

To check the remote function manually:

1 Remove the peristaltic pump remote cable from the remote connector on the rear of the pump.

2 Turn on the pump.

3 Do not allow the pump to operate:

   a Select no direction for pumping by switching to the middle position.

   b Set the flow control switch to a value greater than zero.

4 Using a piece of wire connect:

   - Pin 3 to pin 1 (ground) for counterclockwise pumping.
   - Pin 3 and pin 4 to pin 1 (ground) for clockwise pumping.

Wiring of Peristaltic Pump Remote Cable

The remote cable for the peristaltic pump 1VS is a shielded cable with a 9-pin connector for the valve-pump controller and a 15-pin male connector for the pump. The remote cable for the peristaltic pump 8VS is a shielded cable with a 15-pin connector for the GP-IO connector at the Agilent 8453 spectrophotometer, and a 15-pin male connector for the pump.

To check the wiring of the remote cable:

1 Remove the remote cable from the remote connector at the rear of the pump.

   For peristaltic pump 1VS—remove the remote cable from the valve-pump controller.

   For peristaltic pump 8VS—remove the remote cable from the GP-IO connector at the Agilent 8453 spectrophotometer.

2 Check for electrical continuity between the connectors on the cable as Table 22 or Table 21.

Table 21 Control Signals for Peristaltic Pump 1VS

Pump Connector Pin Number	Valve Controller Pin Number	Function
1	1	Ground
2, 1–2 connected		Remote enable (-)*
3	3	Pump On, CCW (-)
4	2	Direction, CW (-)

* (-) = active low.

Table 22 Control Signals for Peristaltic Pump 8VS

Pump Connector Pin Number	GP-IO Connector Pin Number	Function
1	15	Ground
2, 1–2 connected	14	Remote enable (-)*
3	2	Pump On, CCW (-)
4	1	Direction, CW (-)

* (-) = active low.

The other pins in the cable are not connected.

4
Using the Valve Unit and Valve-pump Controller

Operating Your Valve System 86
Troubleshooting Your Valve System 88
Part Numbers 96
Servicing Your Valve System 98

Operating Your Valve System

You operate your valve units and pumps either manually or remotely. Your software handbooks also describe remote operation.

Table 3 on page 17 shows the Physical Specifications Valve Pump Controller and Table 4 on page 18 the Performance Specifications Valve Pump Controller. Table 5 on page 19 shows the Physical Specifications Valve Unit and Table 6 on page 19 the Performance Specifications Valve Unit.

Before operating your units check the cables are connected and the installation is complete, see "Connecting Cables" on page 44.

NOTE

Do not leave solutions with samples or salts in the tubings overnight or for long periods when not pumping.

Clean the tubing with clean solvent when not pumping for long periods, refer to "Cleaning Tubing and Valve" on page 91.

Operating Your Valve Unit

To turn on line power:

1 Press the line power switch on the front of the valve-pump controller.

Switching Between Remote and Manual Mode

The Remote/Manual switch is at the rear of the valve unit.

1 Press switch down for remote mode.

2 Press switch up for manual mode.

The status lamp on the front of the valve unit is on when the valve unit is in remote mode. You use remote mode to operate the valve unit through your software.

Operating Manually

You use the Manual Advance button at the rear of the valve unit to move the valve one position forwards. You can use the Manual Advance button only when the valve unit is in manual mode.

To operate manually:

1 Press the Remote/Manual switch up for manual mode, see "Switching Between Remote and Manual Mode" on page 86.

2 Press the Manual Advance button to move the valve one position forwards. The display on the front of the valve unit changes to show the next position.

Operating Your Pump

Make sure the pump is connected electrically to the valve-pump controller. If not refer to "Installing Your Peristaltic Pump 8VS" on page 28 or "Installing Your Peristaltic Pump 1VS" on page 46.

To turn on line power:

1 Press the line power switch at the front of the pump.

Switching Between Remote and Manual Operation

When the controller-to-pump cable *is not connected* to the rear of the pump you can operate the pump manually. You can use the switches on the front panel of the pump.

When the controller-to-pump cable *is connected* to the rear of the pump you can only operate the pump remotely. You cannot use the switches on the front panel of the pump. When the pump is on and pumping solvent, the valve-pump controller's status lamps display the pump channel that is pumping.

Troubleshooting Your Valve System

This section has two subsections: Use “Checking the Problem” on page 88 to identify the problem, follow the instructions, and then use “Solving Your Problem” on page 91 to correct the problem.

Checking the Problem

This subsection helps you check these problems:

- “Valve Unit does not Operate” on page 88
- “Leaking Tubing Connectors at Valve” on page 89
- “Leaking Valve” on page 89
- “Contamination Between Ports” on page 90

Valve Unit does not Operate

1. Check the valve unit is connected to the valve-pump controller, see “Connecting Cables” on page 44.
2. Check the power cord for the valve-pump controller is connected, see “Connecting Cables” on page 44, and check the line power switch is on.
3. Check the fuse is intact. If the fuse is defective, see “Selecting Fuse” on page 40.
4. Check the valve unit operates in manual mode, see “Operating Manually” on page 87.
   a. If the valve unit operates in manual mode only, there is probably an electronic fault in the connections between the valve unit and the spectrophotometer. Call Agilent Technologies.
   b. If valve unit does not operate in manual mode:

      Remove valve, see “Changing Valve” on page 92, and check manual operation of the valve drive assembly.

NOTE Some earlier models of the valve drive assembly turn continuously when the valve is not fitted. Place and hold a screwdriver in the slot on the rotor drive to provide mechanical resistance. Do not turn the screwdriver.

If the valve drive assembly does not operate, call Agilent Technologies.

If the valve drive assembly operates, the valve has stuck. Clean the valve, see "Cleaning Tubing and Valve" on page 91.

Leaking Tubing Connectors at Valve

This may be solvent leaks or air leaks causing bubbles in the tubing.

1 Check the connectors at the valve are tightened fully.

2 Check the connectors at the valve are not damaged. If the connectors are damaged replace them, see "Replacing Fittings" on page 94.

Leaking Valve

Solvent is leaking and you can see solvent at the recess on the underside of the valve, or air is being drawn in and also causing air bubbles in the valve tubing.

1 Check there is no restriction before the valve causing reduced pressure in the tubings.

2 If there is no flow in all eight inlet tubings, either the outlet tubing is blocked (see step 4) or the valve is blocked and needs cleaning, see "Cleaning Tubing and Valve" on page 91.

3 If there is no flow in some of the inlet tubings, either these tubings are blocked (see step 4) or the valve is blocked at these positions and needs cleaning, see "Cleaning Tubing and Valve" on page 91.

4 To check if a tubing is blocked, connect the tubing directly to the pump and observe the liquid meniscus while pumping solvent. If the tubing is blocked, replace it.

Contamination Between Ports

This may be caused by too low flow rate or flow restrictions, that is, the previous sample has not been flushed entirely from the tubing or flow cell, and by a defective valve.

To check for Flow Restrictions—Too Low Flow:

1. Check for flow restrictions, for example blocked filter tips, or for bends in the tubing which may restrict flow.
2. Set the flow control to a higher rate or longer pumping time if necessary.
3. Check for dirty tubing. If the tubing is dirty, see "Cleaning Tubing and Valve" on page 91.

To check for a Defective Valve:

This check uses pure solvent in the odd-numbered channels (1, 3, 5, and 7) and a sample solution of about 1 AU in the even-numbered channels (2, 4, 6, and 8). You measure the absorbance in the odd-numbered channels where the pure solvent should give no difference in absorbance compared to the solvent reference, if there is no cross-contamination between two adjacent valve ports. You then repeat the check using sample solution in the odd-numbered channels and pure solvent in the even-numbered channels.

1. Measure a blank on air, that is no flow cell in the sample area, for an instrument zero.
2. Measure the absorbance of solvent directly in your flow cell, that is without passing through the valve. Use this measurement as a solvent reference during the next steps.
3. Prepare a sample solution, that consists of an absorbing substance dissolved in the same solvent to give an absorbance of about 1.0 AU.
4. Place the tubing for valve positions 1, 3, 5, and 7 in the solvent you previously used for the reference.
5. Place the tubing for valve positions 2, 4, 6, and 8 in the sample solution.
6. Pump the solvent and sample solution into the flow cell from each valve position and measure the absorbance of channels 1, 3, 5, and 7 (solvent reference). Make sure the solvent and sample solution reach the flow cell for your selected pumping time. The pumping time depends on the length of tubing.
7. Compare the results with the solvent reference. An absorbance of not more than 0.005 AU for the solvent indicates less than 0.5% cross contamination.

8 Repeat the check with the tubing for valve positions 1, 3, 5, and 7 in the sample solution and for valve positions 2, 4, 6, and 8 in the solvent.

9 Compare the results with the solvent reference.

If there is more than 0.5% contamination of solvent by the sample solution:

1 Check for flow restrictions, see "To check for Flow Restrictions–Too Low Flow:" on page 90.

2 Clean the tubing and valve, see "Cleaning Tubing and Valve" on page 91.

3 If the problem remains, replace the valve, see "Changing Valve" on page 92.

Solving Your Problem

This subsection gives instructions for:

- "Cleaning Tubing and Valve" on page 91
- "Changing Valve" on page 92
- "Replacing Fittings" on page 94

Cleaning Tubing and Valve

NOTE Your choice of solvent depends on your application. Ensure good miscibility of solvents and check for solubility of residues from your sample and salts from previous solutions. Make sure the solvent is compatible with the PEEK, PPS and PTFE materials of the valve and tubing. You may also choose to use a detergent for cleaning.

1 Place the inlet tubings in clean solvent and connect the outlet to your pump. Place the outlet from the pump in a waste container.

2 Pump solvent though the tubing and the valve for a few minutes.

3 Move the valve to the next position.

4 Pump solvent again and change the valve position until all ports have been cleaned.

Changing Valve

Change the complete valve assembly when the following symptoms still occur after cleaning the valve (as described in "Cleaning Tubing and Valve" on page 91) and troubleshooting the tubing (as described in "Leaking Tubing Connectors at Valve" on page 89 and "Contamination Between Ports" on page 90):

- valve leaking;
- air bubbles in tubing leading from valve;
- >0.5% cross contamination between samples;
- valve has stuck (see "Valve Unit does not Operate" on page 88).

To remove the Valve

1. Bring the valve to position 1 if it operates.
2. Turn off the valve-pump controller.
3. Remove the two screws holding the valve to the valve drive assembly, at the front.
4. Remove the valve. You may have to move the valve left, right, up or down to release it from the shaft.

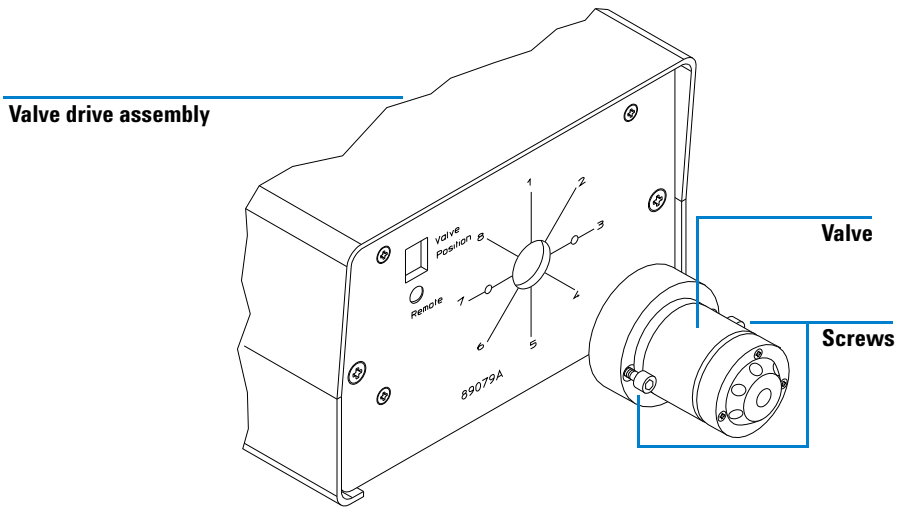


Figure 35 Removing the Valve

To replace the Valve

1 Unpack the new valve. The default position of the valve when shipped is position 1.

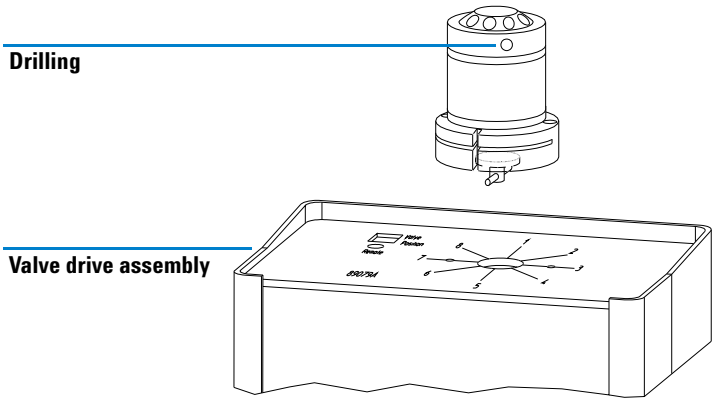


Figure 36 Underside of Valve

2 If the valve drive assembly is not in position 1—switch to manual operation and press the manual advance button to set the valve drive assembly to position 1.

NOTE Some earlier models of the valve drive assembly turn continuously when the valve is not fitted. Place and hold a screwdriver in the slot to provide mechanical resistance. Do not turn the screwdriver.

3 If the valve drive assembly is in position 1—turn off the valve-pump controller, then insert new valve with the drilling facing downwards and the flat side at the end of the axis is in an upward position.

NOTE The shaft has some lateral movement because of its coupling.

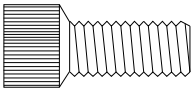
Replace and tighten the two screws. Turn on valve-pump controller and check operation.

Replacing Fittings

To remove fittings, either slide the fitting off the tubing or cut the tubing level with the fitting.

The rest of this section describes how you attach new fittings to the tubing. You will need:

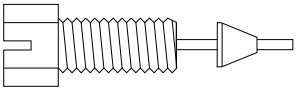
- Fittings (nuts) for tubing-to-tubing connections,



- Ferrules and o-rings,



- Valve fittings for connecting tubing to the valve,



- Tubing cutter, and
- Nut fitting extender.

The tubing kit which is supplied with your sampling system contains a tubing cutter, and nut fitting extender.

NOTE Two types of fittings (nuts) are available. Use the fittings with narrow inner diameter for connecting tubings. Use the fittings with wide inner diameter for dissolution probes.

1. Cut the tubing to the required length use the tubing cutter.
2. Slide a fitting over the end of the tubing.
3. Slide an o-ring over the end of the tubing—the inside of the o-rings are beveled, make sure the narrow end of the bevel points towards the fitting, see Figure 37.

4 Slide a ferrule over the end of the tubing–the ferrules are beveled, make sure the narrow end of the bevel points towards the o-ring, see Figure 37.

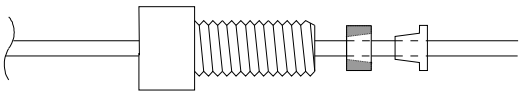


Figure 37 Orientation of Fitting, O-ring and Ferrule on Tubing

5 Pull the tubing through fitting, o-ring and ferrule so that it protrudes about 4 mm (3/16 inch) beyond the ferrule, see Figure 38.

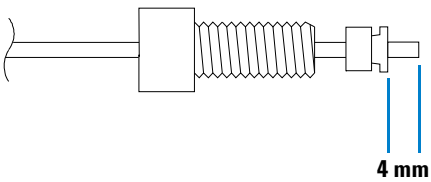


Figure 38 Fitting Ready for Connection to Other Tubing

6 Connect the tubing with the loose fitting, o-ring and ferrule to a tubing with a fixed fitting and use the nut extender tool to tighten the fittings, see Figure 39.

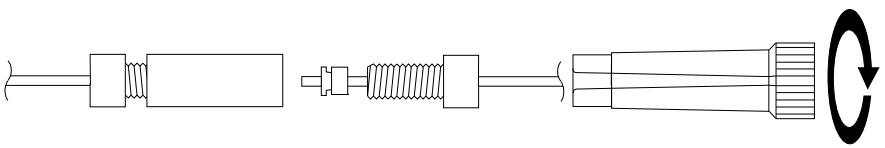


Figure 39 Tightening the Fittings

NOTE Always hold the nut extender tool at the end with the finger grip—optimum tightness is reached when the nut extender tool begins to slip.

Part Numbers

Table 23 shows parts numbers of accessories for the valve, valve unit, and valve-pump controller. For part numbers of accessories for applications using other units (pump, sipper/sampler, autosampler, multicell transport) see appropriate handbook.

Table 23 Accessories for Valve, Valve Unit, and Valve-Pump Controller

Description	Part Number
Complete Units	
Valve-pump controller, 115 V	89078-69001
Valve-pump controller, 230 V	89078-69002
Valve drive assembly*, 50 Hz	89079-69002
Valve drive assembly†, 60 Hz	89079-69003
Valve Parts	
Head	5063-6575
Rotor seal	5067-1539
Cables	
GPIO-to-Controller cable	G1103-61610
Controller-to-valve cable	5062-2407
Controller-to-pump cable	G1103-61612
Fuses	
T315 mA fuse for 230 V AC operation	2110-0449
T630 mA fuse for 115 V AC operation	2110-0450
T1 A fuse (24 V)	2110-0457
T2 A fuse (5 V)	2110-0601
Fittings‡	

Table 23 Accessories for Valve, Valve Unit, and Valve-Pump Controller (continued)

Description	Part Number
Tubing Kits	
Teflon tubing kit, 0.8 mm inner diameter, 1.6 mm outer diameter (10 m)	5041-2191
Valve tubing kit	5042-1331
Peek fittings and ferrules for 8-port valve (10/pk)	5042-1337
Tefzel ferrules (10/pk)	5022-2154
Conical adapter kit, connects teflon tubing to pump tubing (2/pk)	5022-2157
Cell fittings, (8/pk, 4 short and 4 long fittings)	5022-2156
Fittings, nuts (10/pk)	5022-2158
Unions (10/pk)	5022-2155
Peristaltic pump tubing, 2.06 mm inner diameter (12)	5041-2166
General Accessories	
Photographic lens tissue	9300-0761

* Does not include valve.

† Does not include valve.

‡ For part numbers of cell fittings and ferrules, tubing fittings, ferrules, conical adapters and unions, see the UV-visible section of Agilent's *Accessories and Supplies for UV-visible Spectroscopy* Catalog.

Servicing Your Valve System

This section is intended only for use by Agilent Technologies service personnel. It contains a description of the electronics and troubleshooting procedures.

Logic levels of voltages are given as 0 for low level (approximately 0.7 V) and 1 for high level (approximately 4.8 V). To indicate negative true logic on signals, a minus sign is appended to the signal description, for example Rdy(-) for the ready signal.

Voltages are generally measured on the cables with all devices connected because most of the outputs used are open collector without pull-up resistors.

Electronics Overview

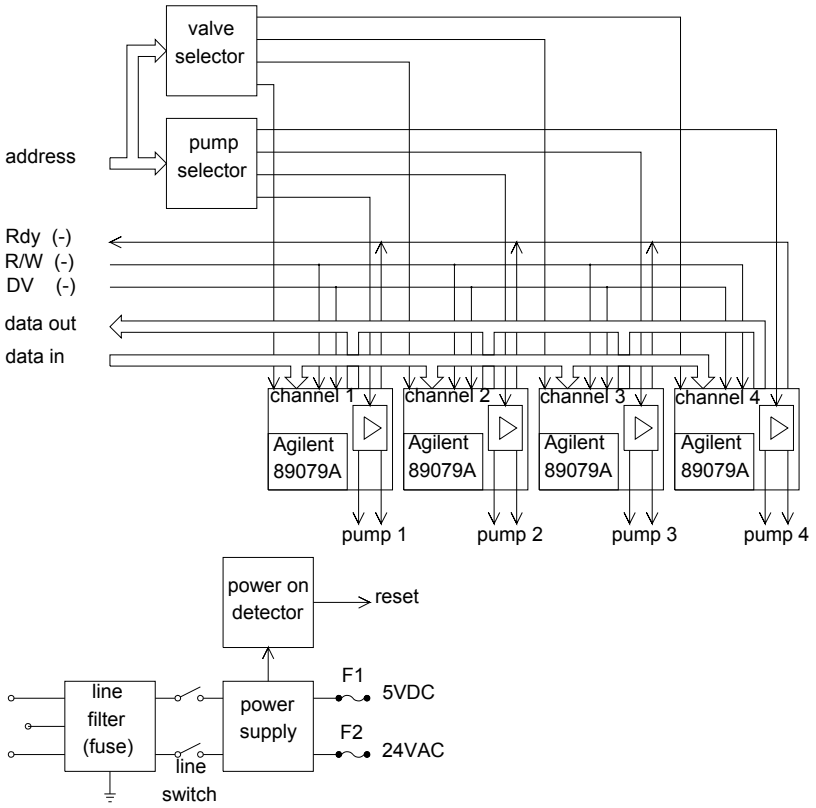


Figure 40 Electronics Overview

Valve Selector, Pump Selector

The valve selector and pump selector decode the address lines (3 bit) from the GP-I0 port of the spectrophotometer and give a pump or valve select signal to the channel in question. Up to 4 channels, that is 4 valves and 4 pumps can be addressed.

Table 24 Address Lines (Controller-GP-IO Cable)

		A2	A1	A0
Valve	1	0	0	0
	2	0	0	1
	3	0	1	0
	4	0	1	1
Pump	1	1	0	0
	2	1	0	1
	3	1	1	0
	4	1	1	1

Channel 1, 2, 3, 4

Data-in lines (D0IN, D1IN, D2IN) from the GP-I0 port of the spectrophotometer are read by the valve-pump controller. The data lines contain either the position setpoint for the valve or the pump direction depending on whether the valve or the pump of the respective channel is selected. Data-out lines (D0OUT, D1OUT, D2OUT) contain position feedback information of the valve from the channel that is addressed.

The data valid line DV(-), ready line Rdy(-) and read/write line R/W(-) are used for handshake with the GP-I0 port of the spectrophotometer.

Power Supply

The line voltage is connected to the line filter, which also contains the line fuse. It is fed through the line switch into the power supply which contains a transformer, rectifier and regulation circuits. The + 5 V DC line is regulated with a linear voltage regulator. The 24 V AC lines are used to drive the valve motors (only one motor is driven at a time to minimize power consumption).

Line Fuse

The line fuse is located in the line filter, accessible from the rear of the valve-pump controller.

T630 mA (2110-0450) is used for 115 V operation.

T315 mA (2110-0449) is used for 230 V operation.

Fuses F1, F2

These fuses are located inside the valve-pump controller on the rear panel connector board, see Figure 41.

F1: T2000 mA (2110-0601) for the 5 V DC line.

F2: T1000 mA (2110-0457) for the 24 V AC line.

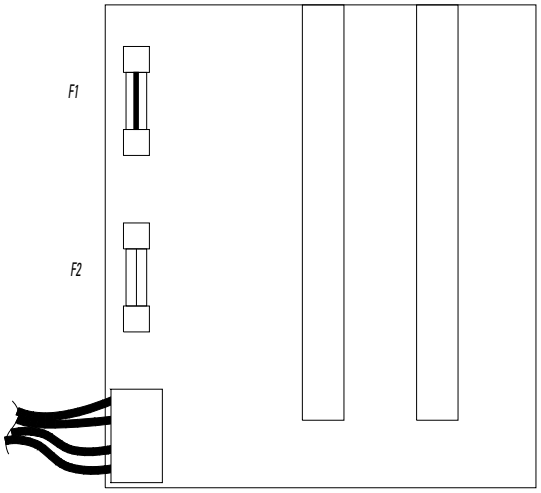


Figure 41 Internal Fuses

Valve and Pump Actuation Electronics

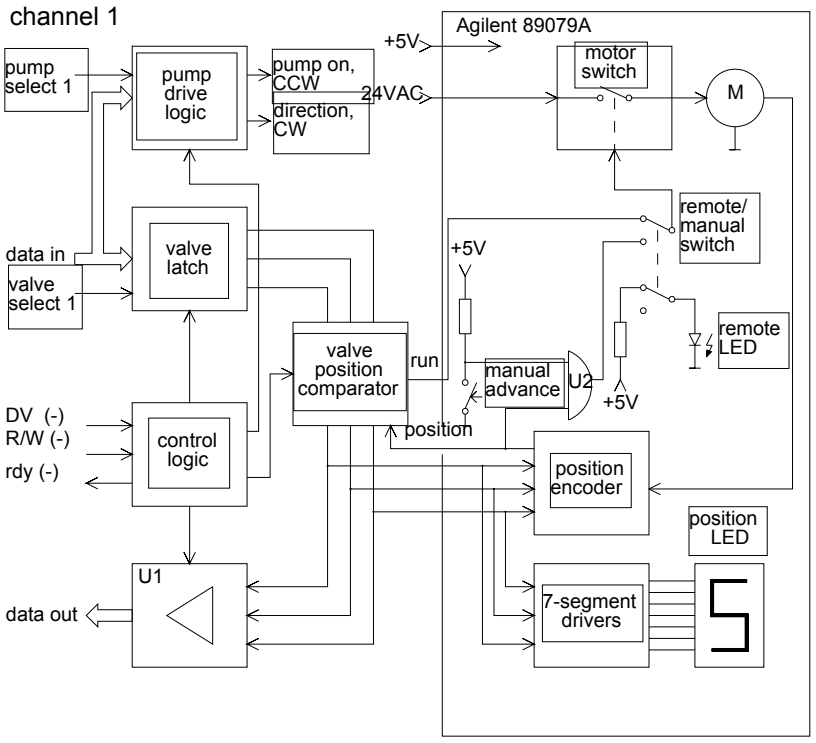


Figure 42 Valve and Pump Actuation Electronics

The block diagram, Figure 42, shows part of the valve-pump controller and the electronics of the valve unit for channel 1 only. Pumps are not shown.

Control Logic

The control logic of the valve-pump controller performs the handshake with the spectrophotometer, and defines the timing for the valve actuation, and for data-in and data-out lines.

The data valid line DV(-) and read/write line R/W(-) from the GPI0 port of the spectrophotometer are used for handshake. A “0” on the read/write line indicates a write cycle of the spectrophotometer, that is address and data are written into the valve-pump controller, see Figure 43.

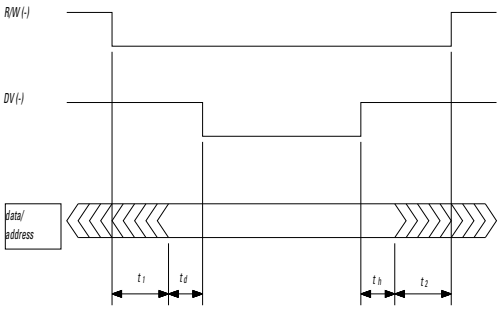


Figure 43 GP-IO Write Cycle

The ready line Rdy(-) is read by the GP-I0 port of the spectrophotometer during a read cycle, see Figure 44. It is “0” when the valve-pump controller is ready to deliver position feedback data from the valve of the channel which is addressed.

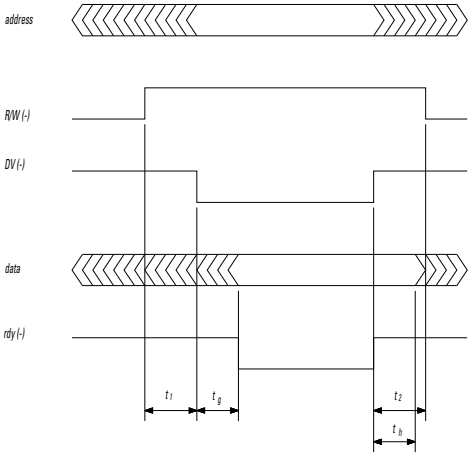


Figure 44 GP-IO Read Cycle

Pump Drive Logic

When pump select signal is active, data-in lines DXIN (from the spectrophotometer) define in which direction the pump of the selected channel has to turn.

Table 25 Pump Actuation (DXIN) Lines only (assuming a pump is addressed)

	D1IN	D0IN
Pump off	1	0
Direction, CW	0	0
Pump on, CCW	0	1

The output lines, Pump On, CCW and Direction, CW will remain in the last stage, until new information is entered from data-in lines.

Valve Latch, Buffer U1

The data-in lines DXIN (from the spectrophotometer) provide the position setpoint for the valve of the selected channel to the valve latch, if the valve select line is active.

The actual position is given to the spectrophotometer on the data-out lines DXOUT through buffer U1 in case of a read cycle.

Table 26 Valve Position Lines (assuming the valve unit is connected and addressed)

		D2OUT D2IN	D1OUT D1IN	D0OUT D0IN
Position	1	0	0	0
	2	0	0	1
	3	0	1	0
	4	0	1	1
	5	1	0	0
	6	1	0	1

Table 26 Valve Position Lines (assuming the valve unit is connected and addressed) (continued)

		D2OUT D2IN	D1OUT D1IN	D0OUT D0IN
	7	1	1	0
	8	1	1	1

Position Encoder, 7-Segment Drivers, Position LED

An encoder wheel on the axis of the valve and three light switches provide a three bit signal for the 8 possible positions of the valve. The actual position of the valve is displayed on the front panel by the position LED which is driven by 7-segment drivers. A fourth light switch is used to sense the fine positioning (position line is “1” if setpoint position is reached). (These lines can be accessed, opening the valve-pump controller-valve cable.)

Table 27 Encoder and Position Lines

		Encoder Bit 2	Encoder Bit 1	Encoder Bit 0
Position	1	0	0	0
	2	0	0	1
	3	0	1	0
	4	0	1	1
	5	1	0	0
	6	1	0	1
	7	1	1	0
	8	1	1	1

Valve Position Comparator

As soon as the setpoint from the valve matches with the actual position and the fine position has been found (position line is “1”), the run signal Run(-) is “1”.

Remote/Manual Switch, Motor Switch

If the remote/manual switch is in remote position, the run line Run(-) connects to the motor switch and the remote LED is lit. As long as the run signal is “0”, the motor turns.

If the remote/manual switch is in manual position, the Remote LED is turned off and the motor switch is activated by the manual advance switch through U2. Once activated, the motor turns the encoder wheel which results in a “0” on the position line. As soon as the next position is found (position line is “1”) the motor stops turning.

To minimize positioning errors, the motor turns in one direction only.

Troubleshooting

Most of the outputs used are open collector without pull-up resistors. Therefore voltages on outputs can only be measured when the pull-up resistors of the respective inputs are connected. To measure output voltages, connect the appropriate cables and open their connectors, unless it is specified otherwise.

Pump Does Not Respond

When trying to turn the pump in clockwise or counter clockwise direction from the computer, the pump does not respond.

✔ Check if pump operates manually:

Unplug the remote cable and check if the direction switch on the front panel of the pump works.

✔ Check if spectrophotometer and valve-pump controller electronics work:

Observe if the channel LED on the valve-pump controller lights when pump is activated from the software.

✔ Check remote operation of the stand alone pump:

1 Connect the valve-pump controller-pump cable because the pump has a remote/manual switch integrated in the remote plug.

2 Take a piece of wire to short the pins 2 and 3 with pin 1 (GND) or 3 with pin 1 (GND) (see Table 28).

Table 28 Controller-Pump Cable (Controller Connector)

	Pin 2	Pin 3
CCW Operation	Open	GND
CW Operation	GND	GND

✔ Check electronics of the valve unit:

1 Open the connector of the valve-pump controller-pump cable which connects to the valve-pump controller to have access to the pins.

2 Connect the valve-pump controller-pump cable to the valve-pump controller and the pump.

3 Measure the logic levels given in Table 29, after entering the appropriate setpoints in your computer.

Table 29 Pump Connector of Controller

	Pin 2	Pin 3
Pump off	0	1
CCW operation	1	0
CW operation	0	0

✔ Check the electronics of the GP-IO port of the spectrophotometer, refer to "Checking GP-IO Output Signals of the Spectrophotometer" on page 109.

Valve Unit Does Not Respond

When trying to switch the valve from the computer, the valve unit does not respond. Either check the valve-pump controller or the valve unit.

Checking whether valve unit is functioning electrically:

1. Press the remote switch up at the rear of the valve unit valve unit to manual operation and use the manual advance switch to operate the valve unit.
2. If valve unit does not function, plug valve-pump controller-valve cable into another channel of the valve-pump controller and use the manual advance switch or, if your software allows it, operate the valve on another channel with your software.

Checking whether valve-pump controller is functioning electrically:

✔ Check 5 V DC, 24 V AC lines on the valve connector of the valve-pump controller. Replace fuses F1 or F2 in the valve-pump controller if necessary. see Figure 41 on page 101.

✔ Check the run line Run(-):

1. Open one of the connectors of the valve-pump controller-valve cable to have access to the pins and plug the cable into the valve-pump controller and valve unit.
2. Select a setpoint on your computer that is equivalent to the actual position of the valve. The run line must be “1” now.
3. Press the remote switch up at the rear of the valve unit to manual mode and use the manual advance switch to set the valve to the next position. The run line must be “0” now, because the setpoint (from the computer) is different from the actual position.
4. If the Run(-) line is defective replace the valve-pump controller.

✔ Check the position line:

1. Disconnect the valve unit from the valve-pump controller.
2. Select a setpoint for position 8 on your computer.
3. Simulate a valve unit on the valve connector of the valve-pump controller by shorting the position line with + 5 V (Pin 3,4) using a piece of wire. (Encoder Bit 0, 1 and 2 are open, which simulates position 8). As soon as the position line is pulled high, the run line Run(-) must be high.
4. If the Run(-) line does not respond replace the valve-pump controller.

✔ Check the electronics of the GP-IO port of the spectrophotometer, refer to "Checking GP-IO Output Signals of the Spectrophotometer" on page 109.

Checking GP-IO Output Signals of the Spectrophotometer

When trying to switch the valve or pump from the computer, no function of valve unit or pump and no pump LEDs turned on although the valve unit operates in manual mode.

✔ Open one of the connectors of the valve-pump controller-GP-IO cable to have access to the pins.

✔ Connect the cable to the valve-pump controller and the spectrophotometer.

✔ Check address lines and data-in lines DXIN using different valve and/or pump positions (and channels if software allows it), see Table 26 on page 104. (When using dissolution testing software, these lines keep the bit pattern of the last GP-IO write cycle, until the next GP-IO write cycle occurs.)

✔ Check the read/write line R/W(-) and data valid line DV(-), refer to Figure 43 on page 103. (Your measuring device must be able to detect logic level transitions.)

Incorrect Reading of Valve Position in Software

Although the valve and pump can be operated from the software, the valve position is not correctly read by the software.

✔ Open one of the connectors of the valve-pump controller-GP-IO cable to have access to the pins.

✔ Connect the cable to the valve-pump controller and the spectrophotometer.

✔ Check the data-out lines DXOUT, refer to Table 26 on page 104. Your measuring device must be able to detect logic level transitions, because the data-out lines are only valid when the ready line Rdy(-) is active.

✔ Check the read/write line R/W(-), data valid line DV(-) and ready line Rdy(-), refer to Figure 44 on page 103. (Your measuring device must be able to detect logic level transitions.)

Cables and Connectors

Table 30 Controller-to-Valve Cable (5062-2407)

Pin Valve-pump Controller	Pin Valve Unit
1, 2	GND
3, 4	+ 5 V
7,8	24 V AC
9	Encoder Bit 0
10	Encoder Bit 1
11	Encoder Bit 2
12	Position
13	Run(-)*
14, 15	24 V AC

* (-) means active low.

Table 31 GPIO-to-controller Cable (G1103-61610)

Pin Spectrophotometer	Pin Valve-pump Controller	
10	1	GND
2	2	A0
3	3	A1
4	4	A2
5	5	D0IN
6	6	D1IN
7	7	D2IN
8	8	R/W(-)*
9	9	DV(-)†

Table 31 GPIO-to-controller Cable (G1103-61610) (continued)

Pin Spectrophotometer	Pin Valve-pump Controller	
14	12	Rdy(-)‡
11	13	D0OUT
12	14	D1OUT
13	15	D2OUT

* (-) means active low.

† (-) means active low.

‡ (-) means active low.

Table 32 Controller-to-Pump Cable (G1103-61612)

Pin Pump	Pin Valve-pump Controller	
1, 2	1	GND
4	2*	Direction, CW
32	3	Pump ON, CCW

* Open collector output up to 500 mA at low level.

5
Parts for Dissolution Testing

Parts for Dissolution Testing 114

Parts for Dissolution Testing

A summary of the available parts and supplies for dissolution testing grouped by sampling systems is available with the following tables.

Table 33 Multicell-transport-based Sampling System (G1127A)*

Description	Part Number
Eight-position multicell transport	G1120A
Multicell Transport for Agilent 8453 UV-visible Spectrophotometer Operator's Manual	G1120-90001
Peristaltic pump 8VS drive assembly, 115 V or	89092-60001
Peristaltic pump 8VS drive assembly, 230 V	89092-60002
Peristaltic pump 8VS pressure-wheel assembly 8 channel	89092-60003
Peristaltic pump–remote cable	G1103-61607
Filter tips (pack of 1000)	5181-1246
Flow cell, 1 mm path length	5063-6570
Multicell tubing kit†	5042-1330
Dissolution probe kit‡	5042-1332
Teflon tubing kit, 0.8 mm inner diameter, 1.6 mm outer diameter (10 m)	5041-2191
Peristaltic pump tubing, 2.06 mm inner diameter (12)	5041-2166
Tefzel ferrules and SS lock rings (pack of 10)	5022-2154

* For part numbers of cell fittings and ferrules, tubing fittings, ferrules, conical adapters and unions, see the UV-visible section of Agilent's *Accessories and Supplies for UV-visible Spectroscopy* Catalog.

† Supplied with pre assembled tubing and fittings.

‡ Supplied pre assembled.

Table 34 Valve-based Sampling System (G1128A)*

Description	Part Number
Filter tips (pack of 1000)	5181-1246
Flow cell, 1 mm path length	5063-6570
Valve system tubing kit†	5042-1331
Dissolution probe kit‡	5042-1332
Teflon tubing kit, 0.8 mm inner diameter, 1.6 mm outer diameter (10 m)	5041-2191

* For part numbers of cell fittings and ferrules, tubing fittings, ferrules, conical adapters and unions, see the UV-visible section of Agilent's *Accessories and Supplies for UV-visible Spectroscopy* Catalog.

† Supplied with pre assembled tubing and fittings.

‡ Supplied pre assembled.

Table 35 Multibath System (G1130A)*

Description	Part Number
Filter tips (pack of 1000)	5181-1502
Flow cell, 1 mm path length	5063-6570
Valve system tubing kit†	5042-1331

* For part numbers of cell fittings and ferrules, tubing fittings, ferrules, conical adapters and unions, see the UV-visible section of Agilent's *Accessories and Supplies for UV-visible Spectroscopy* Catalog.

† Supplied with pre assembled tubing and fittings.

Table 36 Ordering Information for Replacement Parts and Tubing Kits*

Description	Part Number
Filter tips (pack of 1000)	5181-1246
Flow cell, 1 mm path length	5063-6570
Sipper/sampler tubing kit†	5042-1334

Table 36 Ordering Information for Replacement Parts and Tubing Kits* (continued)

Description	Part Number
Multicell system tubing kit‡	5042-1330
Valve system tubing kit**	5042-1331
Dissolution probe kit††	5042-1332
Teflon tubing kit, 0.8 mm inner diameter, 1.6 mm outer diameter (10 m)	5041-2191
Peek fittings and ferrules for 8-port valve (10/pk)	5042-1337
Tefzel ferrules (10/pk)	5022-2154
Conical adapter kit, connects teflon tubing to pump tubing (2/pk)	5022-2157
Cell fittings, (8/pk, 4 short and 4 long fittings)	5022-2156
Fittings, nuts (10/pk)	5022-2158
Unions (10/pk)	5022-2155
Peristaltic pump tubing, 2.06 mm inner diameter (12)	5041-2166

* For part numbers of cell fittings and ferrules, tubing fittings, ferrules, conical adapters and unions, see the UV-visible section of Agilent's *Accessories and Supplies for UV-visible Spectroscopy* Catalog.

† Supplied with pre assembled tubing and fittings.

‡ Supplied with pre assembled tubing and fittings.

** Supplied with pre assembled tubing and fittings.

†† Supplied pre assembled.

See Table 7 on page 23 for details of fittings.

Table 37 Handbooks

Description	Part Number
Agilent 8453 UV-visible Spectroscopy System Installation Guide	G1115-90034
Agilent 8453 UV-visible Spectroscopy System Service Manual	G1103-90004

Table 37 Handbooks (continued)

Description	Part Number
Agilent ChemStation for UV-visible Spectroscopy: Systems Understanding Your Dissolution Testing Software	G1118-90011
Multicell Transport for Agilent 8453 UV-visible Spectrophotometer Operator's Manual	G1120-90001

A
Safety Information

Safety Information 120
Agilent Technologies on Internet 123

Safety Information

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

General

This is a Safety Class I instrument (provided with terminal for protective earthing) and has been manufactured and tested according to international safety standards.

Operation

Before applying power, comply with the installation section. Additionally the following must be observed.

Do not remove instrument covers when operating. Before the instrument is switched on, all protective earth terminals, extension cords, auto-transformers, and devices connected to it must be connected to a protective earth via a ground socket. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in serious personal injury. Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any intended operation.

Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, and so on) are used for replacement. The use of repaired fuses and the short-circuiting of fuse holders must be avoided.

Some adjustments described in the manual, are made with power supplied to the instrument, and protective covers removed. Energy available at many points may, if contacted, result in personal injury.

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible. When inevitable, this should be carried out by a skilled person who is aware of the hazard involved. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present. Do not replace components with power cable connected.

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Do not install substitute parts or make any unauthorized modification to the instrument.

Capacitors inside the instrument may still be charged, even though the instrument has been disconnected from its source of supply. Dangerous voltages, capable of causing serious personal injury, are present in this instrument. Use extreme caution when handling, testing and adjusting.

Safety Symbols

Table 38 Safety Symbols used on Instruments and in Manuals

Symbol	Description
	The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect the apparatus against damage.
	Indicates dangerous voltages.
	Indicates a protected ground terminal.

Table 38 Safety Symbols used on Instruments and in Manuals (continued)

Symbol	Description
	Eye damage may result from directly viewing light produced by deuterium lamps used in detectors and spectrophotometers. Always turn off the deuterium lamp before opening the lamp door on the instrument.
	Rotating pump head creates a pinch and crunch hazard.

WARNING **A warning alerts you to situations that could cause physical injury or damage to the equipment. Do not proceed beyond a warning until you have fully understood and met the indicated conditions.**

CAUTION A caution alerts you to situations that could cause a possible loss of data. Do not proceed beyond a caution until you have fully understood and met the indicated conditions.

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A Safety Information

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In This Book

his handbook provides you with instructions for installing your Agilent dissolution testing system. This handbook has five chapters.

- Chapter 1, “Site Requirements” — This chapter describes the site requirements and contains the specifications for all units applied.
- Chapter 2, “Setting Up” — How to set up your Agilent 8453 UV-visible spectroscopy system and dissolution sampling system.
- Chapter 3, “Using the Peristaltic Pumps 1VS and 8VS” — How to install, operate, maintain and service the peristaltic pumps.
- Chapter 4, “Using the Valve Unit and Valve-pump Controller” — How to install, operate, maintain and service the valve unit and valve-pump controller.
- Chapter 5, “Parts for Dissolution Testing” — Lists of parts and their numbers you need for the different configurations of dissolution testing systems.

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